Engineering
Library

AUG 21 1943

TELEPHONE ENGINEER AND Management

Vol. 47, No. 8. Published monthly by Telephone Engineer Publishing Corporation. Office of Publication, Pontiac, Illinois. Executive and Editorial Offices, 7720 Sheridan Road, Chicago, Illinois. Telephone Rogers Park 3040. Subscriptions: U. S., Cuba, Mexico, $1.50 per year; in all other countries, $3.50. Single copies, U.S.A., 15 cents; single copy JANUARY 15 BLUE BOOK BUYER'S GUIDE $1.00. Subscriptions should be sent to 7720 Sheridan Road, Chicago 26, Illinois. Entered as second class matter at the post office at Pontiac, Illinois, under the act of March 3, 1879.

AUGUST 1943

THE NATIONAL TELEPHONE MAGAZINE

... —
... 2, 3
... 16
... —
... —
... 64
10, 47
... —
... —
... 10
... —
... 64
... 47
... 60
... —
.6, 63
... —
... 68
... —
... —
.7, 49
... 15
... —
.6, 45
... —
... —
... —
... 20
... 56
... —
... —
... 41
... 64
... 57
... —
... —
... 57
... 42
... 44
... 6
... —
... —
... —
3, 45, 47
... 59
... 48
... —
... —
... 64
... —
... 66
... —
... —
... 65
... —
... 12, 13
... —
... —
... 65
Co ... —
... 39
... —
... 65
... 64
... —
... 64
... —

WHEN THE "POPE-HARTFORD" WAS A NATIONALLY-KNOWN CAR . . .

LEICH WAS MAKING TELEPHONES

Recalling deceased contemporary products of Leich's earliest telephones emphasizes the amazing fact that some pre-1914-war Leich instruments are still in service. Probably the prices of these 1907-1913 Leich models seemed very important to purchasers at the time. Now the prices belong to dust-laden files but the quality of Leich-built telephones remains fresh in the minds of hundreds of telephone operating men. Leich pledges that the 1967 telephone man will have equally pleasant memories of his post-1941-war purchases of Leich telephones.

In this issue we are introducing a new name to our authors' list in the personage of L. S. Uphoff, Associate Telephone Engineer of the Public Service Commission of New York. His article "Calculation of Resistance Networks" provides simple and complete instructions which will enable any telephone worker who can use arithmetic to calculate a resistance network for any desired combination of loss and impedance. It is on page 30 of this issue.

▼

We have been receiving a number of letters lately with the phrase "see you in October" tacked on somewhere in the letter. It appears likely that the National convention scheduled for Chicago on October 14 and 15 will have a record attendance. The United States Independent Telephone Association has made a name for itself during the past few years and we hope all Independent telephone men make it their business to attend the business meeting on the above dates. Headquarters are in the Hotel Sherman and hotel reservations should be made soon.

▼

In this issue appear two news items definitely significant. They have to do with rate raises okayed during the recent past. Wartime conditions bring on many expenses in addition to higher wages and it is time for many companies to realize they cannot pay their bills when they operate at a loss. Think it over!

Ray

TELEPHONE ENGINEER

MANAGEMENT · ENGINEERING · MAINTENANCE

& MANAGEMENT

Vol. 47, No. 8 AUGUST, 1943

CONTENTS

- Editor's Column 9
- Letters from TELEPHONE ENGINEER Readers.... 12
- Highlights of the Communications News By Roland C. Davies..... 19
- Convention Dates 20
- Illinois Company Gets Rate Increase..... 22
- First Aid Training—By Erle S. Miner..... 23
- TELEPHONE ENGINEER Short Course—Part IV—Electrical Circuits and D. C. Instruments..... 25
- Storage of Coal Reserves—By Thomas Herdman..... 28
- Calculation of Resistance Networks—By L. S. Uphoff..... 30
- 25 Years Ago in TELEPHONE ENGINEER..... 34
- Line & Desk—Edited by J. S. Reed, Jr..... 36
- Personalities in the News..... 38
- Kentucky Conference Report..... 41
- TELEPHONE ENGINEER Handbook Tables..... 48
- Index to Advertisers..... 62

RAY W. SMITH, Editor—ROY F. SMITH, Advertising Manager
DON C. SORENSEN, Sales Promotion Mgr.
M. T. GRIFFIN, Circ. Mgr.—DOROTHY HOLMES, Prod. Mgr.
BETTY J. GRAY—Editorial Assistant

Published Monthly by
Telephone Engineer Publishing Corporation

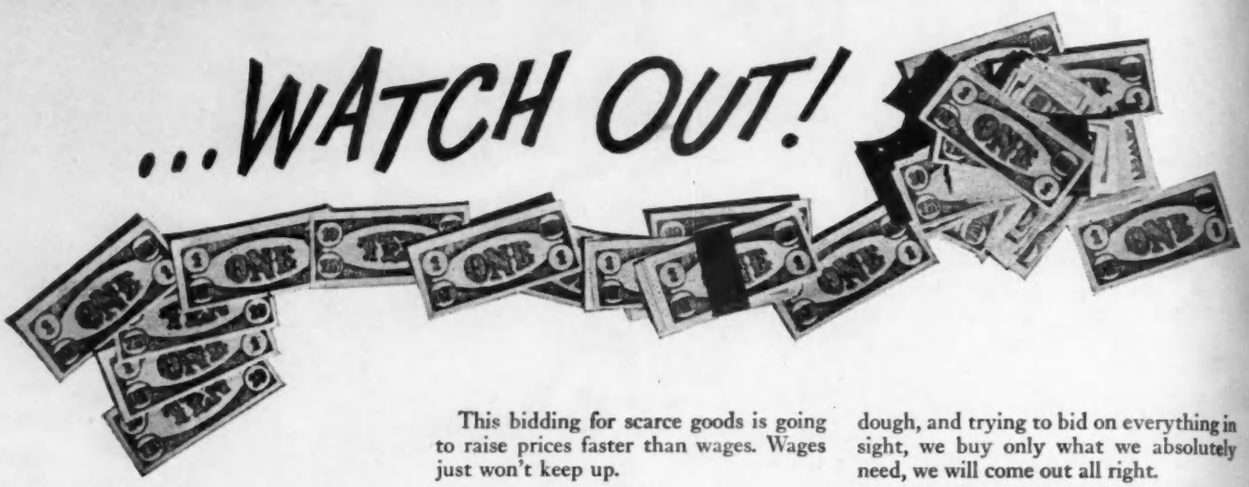
SERVING THE SIX BILLION DOLLAR TELEPHONE INDUSTRY

Founded in 1909

Office of Publication, Pontiac, Illinois. Executive and Editorial Offices 7720 Sheridan Road, Chicago 26, Illinois. Phone Rogers Park 3040. RAY W. SMITH, Editor; ROY F. SMITH, Adv. Manager, DON C. SORENSEN, Sales Prom. Mgr. Subscriptions: U. S., Cuba, Mexico, $1.50 Per Year; Canada, $2.00; In all Other Countries, $3.50. Single copies, U.S.A., 15 cents. Single copy JANUARY 15 BLUE BOOK BUYER'S GUIDE, $1.00. All subscriptions should be sent DIRECT to 7720 Sheridan Rd., Chicago, 26, Illinois.

IF YOU'RE MAKING MORE MONEY

...WATCH OUT!



WE WANT TO WARN YOU, before you read this page, that you've got to use your head to understand it.

We also want to warn you that—if you don't bother to read it carefully enough to understand it—you may wake up after this war as poor as a church mouse.

• • •

This year Americans are going to make —minus taxes—125 billion dollars.

But this year, we civilians are not going to have 125 billion dollars' worth of goods to spend this on. We're only going to have 80 billion dollars' worth. The rest of our goods are being used to fight the war.

That leaves 45 billion dollars' worth of money burning in our jeans.

Well, we can do 2 things with this 45 billion dollars. One will make us all poor after the war. The other way will make us decently prosperous.

This way the 45 billion dollars will make us poor

If each of us should take his share of this 45 billion dollars (which averages approximately $330 per person) and hustle out to buy all he could with it—what would happen is what happens at an auction where every farmer there wants a horse that's up for sale.

If we tried to buy all we wanted, we would bid the prices of things up and up and up. Instead of paying $10 for a dress we're going to pay $15. Instead of $5 for a pair of shoes we're going to pay $8.

This bidding for scarce goods is going to raise prices faster than wages. Wages just won't keep up.

So what will people do?

U. S. workers will ask for more money. Since labor is scarce, a lot of them will get it. Then farmers and business men who

feel the pinch are going to ask more money for their goods.

And prices will go *still higher*. And the majority of us will be in that same old spot again—only worse.

This is what is known as Inflation.

Our government is doing a lot of things to keep prices down . . . rationing the scarcest goods, putting ceiling prices on things, stabilizing wages, increasing taxes.

But the government can't do the *whole job*. So let's see what *we* can do about it.

This way the 45 billion dollars will make us prosperous

If, instead of running out with our extra dough, and trying to bid on everything in sight, we buy only what we absolutely need, we will come out all right.

If, for instance, we put this money into (1) Taxes; (2) War Bonds; (3) Paying off old debts; (4) Life Insurance; and (5) The Bank, we don't bid up the prices of goods at all. And if besides doing this we (6) refuse to pay more than the ceiling prices; and (7) ask no more for what we have to sell—no more in wages, no more for goods—*prices stay where they are now.*

And we pile up a bank account. We have our family protected in case we die. We have War Bonds that'll make the down payment on a new house after the war, or help us retire some day. And we don't have taxes after the war that practically strangle us.

Maybe, doing this sounds as if it isn't fun. But being shot at up at the front isn't fun, either. You have a duty to those soldiers as well as to yourself. You *can't* let the money that's burning a hole in your pocket start setting the country on fire.

★ ★ ★

This advertisement, prepared by the War Advertising Council, is contributed by this Magazine in co-operation with the Magazine Publishers of America.

KEEP PRICES DOWN!

Use it up
Wear it out
Make it do
Or do without

Rigid Specifications

HELP CUT WARTIME USE OF DROP WIRE

Monotype Drop Wire is widely recognized as the quality standard of the industry. Such eminence is not accidental but rather the result of long, tedious weeks of testing, comparing, trying and judging. Finally the nearest-to-ideal combination of materials and methods was evolved.

Eleven separate specifications are rigidly adhered to on insulation alone. The conductor is Copperweld which must pass nine exacting tests and is well-known for its great strength, resistance to elongation and torsion, as well as its high conductivity. Copperweld also helps the conservation program by using relatively small amounts of copper while giving the advantages of solid copper wire.

Obviously quality of this nature is more valuable than ever during wartime. It serves a threefold purpose by restricting replacement, saving service calls, eliminating irritating delays and failures. Your use of Monotype Drop Wire is a sound business move as well as practical patriotism.

MONOTYPE DROP WIRE

MANUFACTURED FOR

AUTOMATIC ELECTRIC COMPANY
By GENERAL CABLE CORPORATION

DISTRIBUTED BY

AUTOMATIC ELECTRIC
SALES CORPORATION

1033 WEST VAN BUREN STREET . CHICAGO, ILLINOIS

"I'M SORRY, PRIVATE PERKINS, BUT WE CAN'T SELL YOU AN EXTENSION IN THE CANTONMENT KITCHEN, EVEN IF IT IS YOUR PERMANENT RESIDENCE."

FACING WARTIME DEMANDS FOR EXTRA SERVICE?

Get Graybar's Help on Supplies

Whether it's Army camp or war plant expansion that's putting extra demands on your telephone system, you'll need all the help you can get in *procurement of essential supplies* to see you through.

GRAYBAR Men keep well informed on the priority and allocation rules applying to the things you need to maintain service. GRAYBAR'S contacts with so many leading suppliers can keep you closely in touch with delivery conditions without individual "follow-up" on your part. You get competent, time-saving help in selecting alternates for unavailable items.

You'll save office-time, too, by using this "one-call" source for everything from the top of the pole to the bottom of the hole.

GraybaR — Everything Electrical .... THAT IT TAKES TO WIN!

IN OVER 80 PRINCIPAL CITIES

Executive Offices: GRAYBAR BUILDING, NEW YORK, N. Y.

LETTERS

from TELEPHONE ENGINEER readers

Dear Mr. Smith:

The Appalachian Electric Power Co. built a line into this section about three years ago and crossed and recrossed our lines several times, and paralleled our lines for a number of miles. Our system being a grounded one wire system it almost put us out of service.

We have tried to get them to pay for making the line serviceable but so far have gotten nothing done.

I would like to know if it would be advisable to take it to the courts.

We are a small mutual concern and have no capital surplus.

Their line was built as cheaply as possible without any consideration for our line.

Yours truly,
A. M. Bernard, Gen. Mgr.
Stuart and Laurel Fork Tel. Co.
Meadows of Dan, Va.

EDITOR'S NOTE: (We know of no law suits on this subject that ended favorably for the telephone company. Perhaps some of our readers have experience of value to Mr. Bernard. If so we would like to have your letter. RWS)

◆

Dear Mr. Smith:

With draft boards taking every available man who has a smattering of knowledge about telephone servicing, where do we go for help?

We now have one man—the manager—for 4 exchanges.

S. A. Rash
Blooming Prairie, Minn.

Try a Telephone Engineer Classified Ad. (Ed. Note)

◆

Dear Mr. Smith:

Along with the submission of my first two lessons of "Electrical Fundamentals" I would like to thank you for an excellent magazine and for the opportunity of taking such a course.

I benefitted greatly from the "Wire Chief's" course and I am looking forward with pleasure to the coming lessons.

Best regards and continued success from

C. L. Ivory
Hildebran, N. C.

◆

Dear Mr. Smith:

I have enjoyed your magazine immensely. Especially in trying to keep up with new developments and ideas of the telephone industry.

Sincerely,
H. James Boyd
Minneapolis, Minnesota

Highlights of the Communications News

Important Communications developments of the past month, briefed for busy readers

by

ROLAND C. DAVIES
Editor, Telecommunications Reports

THE Telegraph Merger hearings before the FCC dragged on at a very slow pace during the latter part of July and early August with the outlook that they might run all of this month and possibly even through September.

That was the main piece de resistance of the FCC activities in Washington, although Chairman Fly and his associates kept a weather eye cocked all the time towards the House investigating committee headed by Representative Cox of Georgia. The Cox body was slated to needle the FCC during the second and third weeks of August with probings into Commission regulatory activities in the broadcasting field.

Until Congress reconvenes September 14, there is little in the offing of concrete developments on future legislation, including the 1943 tax bill (See later in column), that can be forecast.

Army-Navy

THE Army and Navy are now plugging along with their tasks of speeding up procurement of huge supplies to dispatch to the combat forces throughout the globe, but such work in the Navy Department and Pentagon Building are hard, detailed and complicated grinding tasks which do not lend themselves to news developments. Under the helm of the new Chief Signal Officer, Major General Harry C. Ingles, the Signal Corps has been appreciably stimulated and in war planning, procurement and distribution of equipment as well as maintenance, the Corps has been functioning with excellent efficiency.

Independent Activities

THE Independent industry during the latter part of August is engaging in its important conference with the FCC on the maintenance of the Continuing Property Record in the Telephone Uniform System of Accounts. This conference is to be held with the FCC staff and state commission representatives August 19.

Because of the serious accident to vice president and general counsel Ralph Van Orsdel of the Chesapeake and Potomac Telephone Co., the FCC and District of Columbia Public Utilities Commission have postponed the oral argument on the telephone surcharges of hotels, clubs and apartment houses in Washington from August 4 to September 9. This is likely to be a bellwether for state commissions in regard to those surcharges so that it is important both for the Bell System and the Independent industry.

Ventriloquism Breaks Off Long Phone Chat

Two small Cleveland boys apparently hadn't been reading the telephone company's advertising requesting the public to refrain from unnecessary telephoning so that the nation's war effort would not be hindered by overloaded lines and delays on important calls.

They were constantly telephoning each other on a party-line and holding interminable conversions. It was lots of fun. Came the time when the other subscriber on the line, a woman, made three attempts to put through a call, but the conference of the youngsters went on and on.

Then she lifted the receiver a fourth time, waited for a lull in the conversation, pitched her voice to a good imitation of a childish treble, and said:

"Well, goodby."

Both boys hung up, each thinking it was the other's "goodby" ending the conversation.

Power of American Production

ONE of the greatest compliments to American industry in its war production achievements came not from the "bigwigs" in Washington but from the battered typewriter of the able Scripps-Howard war correspondent Ernie Pyle, who is writing circles around practically all his confreres. Pyle wrote about the Sicilian invasion that, if one saw the might of material in battle both in Sicily and in Tunisia, it means the inklings of the enemy collapse and **"we on the scene know for sure that you can substitute machines for lives and that if we can plague and smother the enemy with an unbearable weight of machinery in the next few months hundreds of our young men whose life expectancy was small can some day walk again through their own front doors."**

Faced with its largest procurement task in history, the Army Signal Corps is planning the complete placing of all contracts for 1944—an aggregate amount of 4½ billions—for wire communications, radio and electronic equipment by next January 1, 1944 as far as is possible. This program is being directed by Major General William H. Harrison, the commanding general of the Signal Corps Procurement and Distribution Service who has resigned recently from his vice presidency and chief engineership of the American Telephone and Telegraph Company from which he had been on leave since July, 1940, for government and military service.

That the communications manufacturing industry has to respond to this load is emphasized by the warnings of General Somervell, Commanding General of the Army Service Forces, and WPB executive vice chairman Charles E. Wilson that the armed services must receive their full quotas of supplies to win the war. The Signal Corps, General Somervell has pointed out, has to fulfill about 67 per cent of its 1943 production quota in the remaining months of this year. This puts the challenge right up to the communications manufacturing industry to carry on for the "home front."

* * * *

Most Hopeful Signs

MOST important "home front" development for all business and industry—and for individuals—was the recent pronouncement by Senator George, able and thoughtful Chairman of the Senate Finance Committee which handles tax legislation on the Senate side of the Capitol, that new tax levies can NOT go beyond five or six billions instead of the 12 billions

of new taxes proposed by President Roosevelt. He was joined in the goal of exercising the utmost caution in increasing taxes by House Ways and Means Committee Chairman Doughton. Senator George in forthright language stated that further drastic increases in the individual income taxes might destroy the middle class. He felt disposed NOT to carry the normal and surtax rates on corporations to more than 45 per cent from their present rate of 40 per cent. He predicted that next year being an election year the forthcoming 1943 tax act will certainly go on for 1944 with no 1943 individual and corporate income tax rates being retroactive and increases only effective on and after Jan. 1, 1944. In view of this stand by the two Congressional taxation leaders, it is believed that all the marshalling of statistics by Secretary of the Treasury Morgenthau on the rate of taxation of Canada and the United Kingdom (which do not include state taxes) will not prevail to shake this position of blocking too drastic increases in levies.

At long last, Congress is aroused over the spending and lack of effort by the Administration to institute economies. (As an example most non-military agencies are filling jobs whenever any vacancies occur and despite the fact that with the change to war tempo the work is nonessential, seem unwilling to turn back funds to the Treasury.) Senator Byrd, together with other leading Senators like Radcliffe of Maryland, Wherry of Nebraska etc., are leading a movement to demand that the Administration cut down nonessential outgo. The major point being made by these Congressional economy advocates is that President Roosevelt in his recent resurvey of the Budget during which he advocated the increase of 12 billions of taxes cited only $110,000,000,000 of the $330,000,000,000 in war appropriations made since July 1, 1940, have been paid out by the Treasury. This was deemed too wide a spread by Senator Byrd who feels the Government could carry on for two years without making another appropriation and warned Congress to give the closest scrutiny to future colossal appropriations.

Toll Divisions

A TABULATION which showed estimated net additional payments of approximately $20,000,000 annually by the American Telephone & Telegraph Long Lines Department to the Associated Bell System Companies and the Independent connecting carriers as a result of the FCC rate reduction, negotiated with the company in January, 1943, was recently published by the National Association of Railroad and Utilities Commissioners. The estimates were furnished to the NARUC by the A. T. & T. and Bell System in compliance with the request made during the negotiations by the Committee of Cooperating State Commissioners.

The figure of $20,000,000 was estimated on the basis of the volume of business for the months of September, October and November, 1942, and then multiplied by four. It was noted that the volume of long distance traffic at the present time is approximately 18% greater than during the latter part of 1942 so that the increased payments by the Long Lines Department to the Associated Companies and their connecting carriers, resulting from the changes in the basis for division of revenues from their joint business, now exceeds the $20,000,000 estimate by approximately that percentage.

For the Bell System Companies the estimates of increased divisions of revenues for jointly handled long distance traffic as reported by the Bell System Companies were listed as follows: New England Tel. & Tel. $1,067,500; New York Tel. Co., $2,813,300; New Jersey Bell $946,200; Bell of Pa., $1,343,100; Diamond State $120,700; C. & P. (D.C.) $847,800; C. & P. (Baltimore) $635,000; C. & P. (Va.,) $1,149,100 C. & P. (W. Va.,) $225,300; Southern Bell, $2,862,000; Ohio Bell, $1,121,100; Michigan Bell, $815,900; Indiana Bell, $734,900; Wisconsin Telephone, $505,100; Illinois Bell, $1,529,900; Northwestern Bell, $570,000; Southwestern Bell, $1,357,600; Mountain States, $116,500; Pacific Telephone & Telegraph a decrease of $1,046,000 in compensation from Long Lines if changes made on same basis as for other Associated Companies, still under negotiation; Southern New England, $928,400; Cincinnati and Suburban Bell, $185,600; and Bell of Canada, $420,000.

For connecting carriers (Independents) the tabulation shows an estimated amount of additional divisions on interstate traffic of $1,827,800. If the Independent connecting carriers are compensated on the same basis (station-to-station) by the Associated Bell Companies for intrastate toll traffic the tabulation estimated the additional payments would aggregate $4,019,700.

In the case of the additional divisions for connecting companies, the following amounts for interstate and intrastate business **respectively** are given in the tabulation: New England, $21,800 and $66,600; New York, $110,000 and $335,000; New Jersey, $15,900 and $4,600; Pennsylvania, $57,600 and $284,300; Virginia, $30,000 and $100,000; Maryland, $5,200 and $800.00; West Virginia, $21,000 and $25,000; Southern Bell territory, $425,000 and $450,000; Ohio, $163,500 and $436,500; Michigan, $68,900 and $132,100; Indiana, $154,000 and $247,000; Wisconsin, $103,000 and $165,000; Illinois, $106,300 and $339,900; Northwestern Bell territory, $223,000 and $207,000; Southwestern Bell territory $222,800 and $388,600; Mountain States, $25,000 and $28,000; Pacific Tel. & Tel., territory, $65,000 and $645,000 (estimated as still under negotiation); Southern New England, $2,300 and $2,000; Cincinnati Suburban, $7,500 and $7,300.

The reduction in overtime rates will decrease the prorates to Associated Companies by a total of $3,462,700. Similarly there will be a decrease in Long Lines prorates and commissions on private line and TWX services (due to rate reductions) for the Associated Companies amounting to $763,200.

Post Office Survey

A SURVEY of the Post Office Department's accounting and cost

Convention Dates

United States Independent Telephone Association, Hotel Sherman, Chicago, October 14 and 15.

Virginia Independent Telephone Association, Roanoke Hotel, Roanoke, November 4 and 5.

North Carolina Independent Telephone Association, Washington-Duke Hotel, Durham, November 8 and 9.

South Carolina Independent Telephone Association, place not selected, November 10 and 11.

Oklahoma Telephone Association, Huckins Hotel, Oklahoma City, November 29 and 30.

A QUESTION!

By an Independent Telephone Pioneer

Through what waters would a ship pass from Odessa on the Black Sea to Hong Kong, China? (Turn to page 60 for answer.)

ascertainment systems with the aim of improving the methods and with the goal of reducing postal and airmail rates after the war is to be conducted by two retired American Telephone and Telegraph Company retired chief accounting officials—former A.T. & T. Comptroller Charles A. Heiss and former Assistant Comptroller Allen B. Crunden who were retired from the Bell System this year under the 65-year automatic age provision.

The two former A.T. & T. officials received their oaths of office July 15 from Postmaster General Walker. Curiously, they will be working in the same building in Washington—the New Postoffice Building—as the FCC. It will be an anomaly for them to have been selected for this work in the same building where the FCC and its staff during the Telephone Investigation and other cases had examined them in a critical way as to their objectives and methods of accounting for the Bell System.

NARUC Conference

WARTIME regulatory problems and the issue of state autonomy in the regulation of public service enterprises will be the predominant topics discussed at the 1943 War Conference of the National Association of Railroad and Utilities Commissioners to be held in Chicago September 14-16. The conference has been skeletonized into a two and one-half day meeting.

A major subject of interest will also be the presentation of the Depreciation Report by the NARUC Committee, headed by Nelson Lee Smith, who heads the Board of Transportation Investigation & Research working with the ODT and ICC. This committee began work on its report over two years ago and had hoped to complete the report for presentation to the NARUC in 1942 but deemed it desirable to have more time for the completion of its work and more thorough study of the subject.

The speakers, representing the Federal branch of the government, include Chairman Clarence F. Lea, of the House Interstate & Foreign Commerce Committee, ODT Director Joseph B. Eastman; ICC Chairman Alldredge; and, Director Robert A. Nixon OPA Transportation & Public Utilities Division. For the first time in several years no member of the FCC has been invited as a special speaker on the program.

"Utility regulation during wartime" is another highly interesting topic assigned for round-table discussion. This will include the subjects of a fair rate of return under war conditions; the OPA policies on rate regulation and

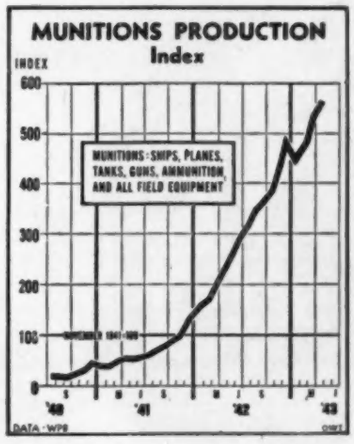
the increases in taxes, including those brought about by fuel adjustment clauses; and, the impact of war taxes and to what extent they should be approved as operating expenses.

In regard to state autonomy in the regulation of public service enterprises, the Federal Communications Commission is one of three Federal agencies to be considered on this issue. Undoubtedly the FCC's desire to regulate interstate interzone telephone surcharges, made by hotels, clubs and apartments will be one of the questions brought up in this discussion.

Recognizing War Conditions

ILLUSTRATING that many regulatory commissions are giving recognition to wartime conditions in passing upon rate situations, the National Association of Railroad and Utilities Commissioners has just issued a recapitulation of decisions and policy determinations by Federal and State commissions, including several telephone rate cases, which in the main opposed rate adjustments, reductions or investigations for the duration of the emergency.

The NARUC cited that the Massachusetts Department of Public Utilities had refused to undertake a statewide rate investigation of the New England Telephone and Telegraph Co.,



partly on the ground that such a project would be untimely when the resources of the company are needed by the nation's war effort;***the Wisconsin Commission in denying telephone and contract motor carrier rate increases held that rates for utility services, if within the range of reasonableness, should be "frozen" and in the Milwaukee Gas Light Co. rate increase under an automatic adjustment clause ruled that the OPA had no authority to petition for or interest itself in a rate decrease case and that the increase through this automatic adjustment was not contrary to the Emergency Price Control Act;***the Kansas Commission indefinitely postponed proceedings upon the petition of the Southwestern Bell for increased rates upon the ground that rates should be stabilized for the duration of the emergency;*** the Oklahoma Commission in prescribing rate reductions for the Southwestern Bell expressed the view that no increases should be granted during the emergency.

The Pennsylvania Commission, with Commissioner Buchanan dissenting, announced a wartime rate policy that it deemed the institution of formal investigations of rates producing increased earnings was inadvisable during the war where utilities refrain from the payment of dividends or the increasing of salaries of executives materially higher than similar payments in peacetime;***the Indiana Commission held that a rate increase for the Greenfield Gas Co. did not violate the Federal Government stabilization policy;***the New Jersey Board of Public Utilities Commissioners rejected reproduction cost evidence while war conditions continue.

Excess profits taxes were allowed as operating expenses in the American Airlines rate case of the Civil Aeronautics Board. However, the Federal Power Commission in the Panhandle Eastern Pipeline case ruled war emergency taxes above the level prescribed in the 1940 Revenue Act will not be allowed as operating expenses. The Arkansas Commission required the Arkansas Power & Light Co. to discount its December, 1942, bills to customers by $625,000 to keep that utility out of the excess profits tax column. Interstate Commerce Commissioner Eastman in a concurring opinion in the Ex-Parte number 148 case held that only the most rigid control unremittingly exercised from the outset can be an adequate safeguard against inflation and that public utility corporations are inappropriate mediums for collecting excess profits taxes.

Company-Wide Rate Increase Granted Illinois Telephone Company

IN an order signed July 13 and effective August 1, 1943, the Illinois Commerce Commission granted the Illinois Telephone Company a company-wide increase in rates. The exchanges affected are located in Alexander,Bluffs, Jacksonville, Literberry, Meredosia, Murrayville, Woodson, Greenfield, Roodhouse, White Hall, Hillview, Manchester, New Berlin, Patterson, Carrollton and Pleasant Plains, Illinois.

The Illinois Telephone Company has had a plant and operators' union for the past several years and the gradual increase in wage level reached a point where an increase in rates was necessary.

According to the Commission's order, approximately $48,000 of additional gross revenue will be realized, and with this additional revenue, the net income of the company should be sufficient to pay approximately 4.89% on an approximate value of $1,250,000 found by the Commission which is considerably lower than that contended for by the company.

The Hillview, Manchester and Patterson exchanges serve 109 stations. Rates granted were as follows: Business; one party from $2.00 to $3.50, rural multiparty from $2.00 to $2.50, extensions unchanged at $1.00. Residence; one party from $1.75 to $2.25, four party from $1.50 to $2.25; rural multi-party from $1.50 to $2.00, extensions unchanged at $.50

The exchanges at Alexander, Literberry, Murrayville and Woodson serve 411 stations. Increases allowed were: Business; one party from $3.00 to $3.50, two party unchanged at $2.50, rural multiparty from $2.25 to $2.50, extensions unchanged at $1.00. Residence; one party $2.00 to $2.25, four party from $1.75 to $2.00, rural multi-party from $1.75 to $2.00.

The Bluffs exchange serves 274 stations with 79 as switching customers. Switching service was raised from $.50 to $.75. The Bluffs exchange rates were raised to the level as those given above. The Meredosia exchange serves 135 stations of which 67 are switched, and the same rates apply.

At New Berlin and Pleasant Plains, Ill., serving 392 stations, the rate increases were: Business; one party from $3.00 to $3.50, rural multi-party unchanged at $2.50, extension from $.75 to $1.00. Residence; one party from $2.00 to $2.25, four party to $2.00, rural multiparty from $2.00 to $2.25. Joint user service, business $1.75 and residence $1.00.

The Greenfield, Ill., exchange serves 212 stations. The increases allowed are the same top level as reported above.

The Roodhouse and White Hall, Ill., exchanges serve 809 stations. Increases allowed were: Business; one party from $3.25 to $4.00, two party from $3.00 to $3.50, rural multi-party unchanged at $3.00, extensions at $1.00. Residence; one party $2.25 to $2.50, four party $2.00 to $2.25, rural multi-party from $2.00 to $2.25, extension at $1.00 and joint user service for business $2.00, residence $1.25.

The Winchester exchange serves 417 stations. Increases given were: Business; one party from $3.25 to $4.00, two party from $2.75 to $3.50, rural multi-party from $2.75 to $3.00, and extensions from $.50 to $1.00. Residence; one party from $2.25 to $2.50, two party from $1.75 to $2.25, rural multi-party unchanged at $2.25 and extensions unchanged at $.50. Joint user service is now, business $2.00, residence, $1.25.

The Carrollton exchange serves 777 stations. Rate increases ordered were: Business; one party from $4.25 to $4.50, two party $3.75 to $4.00, rural multiparty from $2.50 to $3.00, with extensions unchanged at $1.00. Residence; one party unchanged at $2.75, two party unchanged at $2.50, four party unchanged at $2.25, rural multi-party from $2.00 to $2.25. Extensions unchanged at $.50.

The largest exchange of the group is at Jacksonville, Ill., and serves 3940 stations. Of these, 1667 are four party residence stations. Increases ordered were: Business; one party from $4.75 to $5.75, two party from $4.00 to $5.00, rural multiparty from $2.50 to $3.00, extensions unchanged at $1.00. Residence; one party from $3.00 to $3.75, two party from $2.50 to $3.25, four party from $2.00 to $2.75, rural multi-party from $2.00 to $2.50, extensions unchanged at $.50.

Under the old rates the company charged a penalty of $.25 per month for failure to pay bills promptly. Under the new rates no such penalty is contemplated.

. . . adequate communications facilities and the maintenance of a strong, cohesive, and far-flung communications system are as vital to the prosecution of the war as is the production of guns, airplanes, tanks, and ships.—*Senate Committee on Interstate Commerce.*

List of American Standards

The American Standards Association has announced publication of its new List of American Standards which will serve a useful reference piece to the engineering and purchasing departments of manufacturing firms.

More than 600 standards are listed, 94 of which represent new and revised standards approved since the last (August 1942) issue. These are marked with the asterisk.

Standards are listed by subject and cover civil, mechanical, electrical, mining, chemical and other engineering fields as well as metals and materials, specifications of interest to the textile, wood, pulp and paper industry, methods of test for the finished product, dimensions, etc. They reach into every important field and serve as a basis for many municipal, state and Federal regulations. By frequent review these standards are kept abreast of new developments in the fields to which they relate.

This List of American Standards for 1943 will be sent free of charge to anyone writing in for it. Requests should be addressed to the American Standards Association, 29 West 39th Street, New York.

Cotton Used for Telephone Cases

The Signal Corps, as part of its campaign to save millions of dollars and yet insure the full use of vital critical materials, recently substituted cotton fabric for leather in the manufacture of carrying cases for field telephones, the War Department revealed July 15.

Because of its weight and the rough treatment it receives during battles, the field telephone was formerly carried in a heavy leather case, but after experimentation and tests at the Signal Corps Laboratories at Fort Monmouth, N. J., a cotton carrying case was evolved that not only is as strong as leather, but in some respects superior.

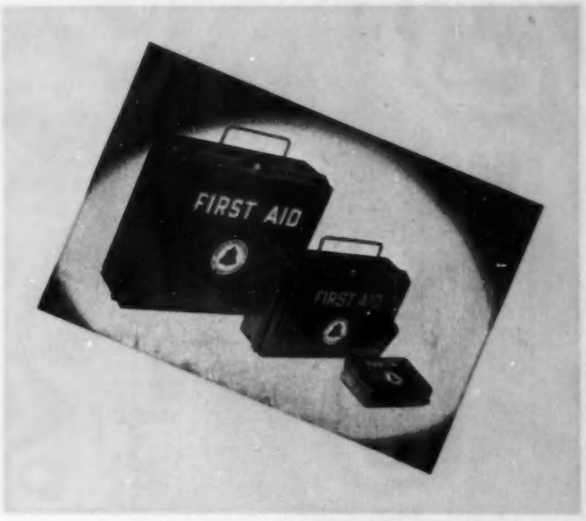
Minnesota Exchange Sold

The Minnesota Railroad and Warehouse Commission on July 29 ordered the petition of the Northwestern Bell Telephone Company to buy the Pine Tree Lake Cooperative Telephone Company, Washington County. Labor and materials made it impossible for the small company to continue in business and as there was an airport in the area it was deemed that service should be continued.

A
MANAGEMENT
ARTICLE

★

First Aid *Training*



Here are three sizes of Bell System first aid kits: the tools which help the telephone first aider to apply his knowledge and skill

By ERLE S. MINER
Bell Telephone Magazine

TELEPHONE men and women have shown their eagerness to buy bonds, to conserve rubber, to "get in the scrap," to take every step by means of which the home front can contribute to victory. And since Pearl Harbor, increased thousands of them have taken first aid training.

These new "first aiders" come from all departments and from all levels of the telephone organization. Because of their training, they are now prepared to serve more effectively as air raid wardens, nurses' aids, auxiliary firemen and policemen, and in other civilian defense activities. Many of them, further, are competent to instruct Red Cross classes in their respective communities—and are so doing.

A sharp acceleration in Bell System first aid activity is significant. During recent years, about 7,000 employees have qualified for first aid certificates annually. In the twelve month period following our entry into the war **more than 55,000 employees** completed their training. More than a third of all the employees in the System, it is estimated, have now had first aid instruction. What is more, there are in the System approximately 3,500 qualified first aid instructors.

Not least among the benefits of first aid instruction is the fact that in telephone buildings throughout the System there now are trained rescue squads, ready to assist in evacuating designated areas—including transportation to shelter if enemy attack should necessitate evacuation of certain offices —in rendering necessary first aid, and in giving care thereafter. Because of long experience in first aid work, the Associated Companies were able in short order to plan for the care and protection of their own people who are the guardians of the Bell System's communication service of a nation at war.

Nor is it a negligible accomplishment that most of the thousands of telephone men who are now in the armed forces have had first aid training.

The activity is not new to the System, however. Actually, it was first introduced 30 years ago with the assistance and cooperation of the American Red Rross.

THE extent of first aid training has varied somewhat from year to year, largely in ratio with the number of new employees entering the business. During the depression of the early 'thirties, when few were being employed, there was less than usual activity. More recently there has been a definite revival of interest, not only in training new employees but in providing review courses for those who had received their instruction some years before.

This renewed activity raised a number of questions which during 1940

Women Employees Show their Proficiency—These first aid students represent various departments of an operating company. Two instructors train a group of this size.

Staged Realism—This was the problem posed for one company's first aiders. As they went to work on the "victims," a play-by-play account of the steps they took was given the audience by loud-speaker.

Special Edition—This standard Red Cross instruction text has a special cover and a foreword addressed to Bell System employees.

made it desirable to take a broad look at first aid in the light of past experiences, particularly as to what plans should be made for a continuing program. It was evident that procedures based upon such a review should lead toward greater uniformity in first aid training in the Bell System, and with it an increase in the effectiveness of all its benefits.

One point to receive particular consideration was the development of a working arrangement, in effect a joint agreement, with the American Red Cross, to which all the Associated Companies might subscribe. Some of them had been operating under Red Cross agreements executed during the early 1920's, and others had not.

The agreement covers first aid instruction and certification procedures which meet the standards and carry the endorsement of the American Red Cross, and provides for training and certifying Bell System first aid instructors and for means to keep both instructors and regular "first aiders" up-to-date in the latest first aid methods.

THE Red Cross standard course is the basic course regularly offered to telephone employees. Twenty hours of training are required—with whatever reasonable additional time may be necessary in the judgment of the instructor. For effective teaching, classes are limited to not more than 20 students. Upon successful completion of the standard course, joint Red Cross-Telephone Company first aid certificates are issued.

The advanced course is a ten-hour course providing additional study and practice beyond the standard course. It includes, in addition to a review of the knowledge of first aid acquired in the standard course, a number of practical problems designed to develop further the first aider's skill. Enrollment in the advanced course requires previous qualification in the standard course and, upon its successful completion, advanced course certificates are issued jointly by the American Red Cross and the telephone companies. This course was not provided for in the previous arrangements with the Red Cross.

Another significant change with respect to the certificates of proficiency in first aid concerns the length of time during which the certificates are valid. Under the former procedure, certificates were issued to each employee-graduate of the standard first aid training course, but these certificates carried no expiration date. Now, all standard course certificates expire at the end of a designated period. Then the employee may enroll in the advanced course and upon completing it may receive the advanced course certificate—which places him in good standing for another similar period. He may then again take the advanced course, and so on for subsequent periods. In this way the individual employee's knowledge of first aid, and his skill in administering it, will be given a definite continuity.

IT is generally recognized that the success of any training program depends largely upon the abilities and sincerity of the instructors. They must not only possess the necessary knowledge and skill, but they must also know how to teach and have the necessary equipment for proceeding with the instruction. Since most of the telephone company first aid instructors teach only a limited number of classes each year, it seemed particularly important to include in the joint agreement procedures for assuring that the corps of Bell System first aid instruc-

(Please turn to page 42)

NO JOB IS SO IMPORTANT
AND NO SERVICE IS SO URGENT—
THAT WE CANNOT TAKE TIME
TO PERFORM OUR WORK SAFELY.
BELL SYSTEM

Telephone Engineer's TRAINING COURSE

☆

ELECTRICAL FUNDAMENTALS FOR THE TELEPHONE MAN

☆

Electrical Circuits and D. C. Instruments---Part IV

Electrical Measurements

ELECTRICITY being a colorless, weightless and invisible medium it is highly essential that we be able to detect its presence and measure its characteristics; otherwise, we would be unable to properly control it. The electrical or radio student or the practical technician should be familiar with the various types of measurements which can be made by means of testing instruments and should have a good working knowledge of all of the different types of testing instruments and understand their use in circuit applications. This section of the course deals with electrical measurements, and the theory and use of electrical testing instruments.

Types of Electrical Measurements

THE table given below shows the various measurements, the name of the instrument used to make the measurement, and the usual unit of measurement.

Name of Instrument	*Type of Measurement*	*Usual Unit of Measurement*
Voltmeter	Voltage	Volts
Ammeter	Current	Amperes
Wattmeter	Power	Watts
Resistance Bridge	Resistance	Ohms
Impedance Bridge	Reactance (inductive)	Ohms
Impedance Bridge	Reactance (capacity)	Ohms
Impedance Bridge	Inductance	Henries, millihenries
Capacity Bridge	Capacity	Microfarads
Frequency Meter	Frequency	Kilocycles, or cycles

Different Instruments Required for D. C. and A. C.

IN dealing with electrical testing instruments, one must keep in mind that we cannot ordinarily measure alternating current with the same meters that we use in direct current work or vice versa. Likewise, we must also recognize that in making measurements on A.C. circuits we must use different meters for different frequency ranges. For example, a voltmeter suitable for recording the voltage of a 110 volt 60 cycle house circuit would not serve at all on a radio frequency circuit. Alternating current measurements can be regarded as falling into five frequency ranges as shown in the following table:

Five Classes of A. C. Measurements

1. Low frequency (0 to 133 cycles)
2. Voice or audio frequency (100 to 10,000 cycles)
3. Carrier frequency (10,000 to 50,000 cycles)
4. Radio frequency (50,000 to 56,000,000 cycles)
5. Ultra-high frequency (above 56,000,000 cycles)

Direct Current Galvanometer

ONE of the simplest types of measuring instruments for direct current is the galvanometer. Galvanometers are not common in ordinary work and are found primarily in schools and laboratories. The term "galvanometer" is derived from the fact that the first instruments were used for measuring "galvanic currents." As used at the present time it refers to the more sen-

sitive and delicate type instruments used in laboratories and schools primarily for the purpose of indicating the presence of minute electrical currents or voltages and not for the quantitative measurement of voltage or currents as are voltmeters and ammeters.

Essential Parts of Galvanometer

A galvanometer consists essentially of a permanent magnet and a movable coil to which is attached either a tiny mirror or a light weight indicating needle. The coil is suspended between the poles of the magnet by delicate phosphor bronze wires or in some cases by means of a tiny shaft operating in jeweled bearings. Figure 55 illustrates a typical galvanometer such as is found in schools and colleges for use in lecture room and laboratory work.

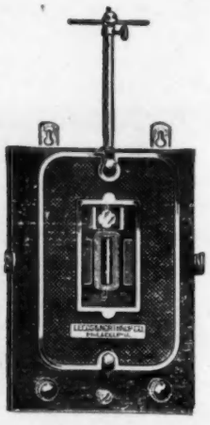


Fig. 55. — Typical galvanometer of type used in schools and laboratories

The theory of operation is very simple and is as follows: When current is passed through the coil from the source under measurement, the electro magnetic field established around the coil reacts with the permanent magnetic field of the magnet causing the coil to revolve so as to embrace the maximum number of lines of magnetic force from the permanent magnet. The coil in turning causes a needle to move over a calibrated scale, or in the case of a mirror type galvanometer, a light beam reflected from the tiny mirror is caused to move across a scale.

Purpose of Iron Core

IN order to get greater sensitivity, most galvanometers have a soft iron core positioned in the center of the coil and so arranged that the coil rotates around the soft iron core. The core serves to concentrate the magnetic flux from the permanent magnet thus offering a lower reluctance path than does an air core.

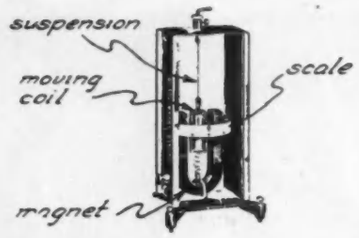


Fig. 56. — Basic elements of a galvanometer

Great sensitivity is obtained with moving coil galvanometers by locating the screen, on which the light beam reflected from the tiny mirror falls, some distance away from the instrument. Thus a small movement of the coil is greatly magnified on the scale as would be the case were a long pointer attached to the coil.

A galvanometer can easily be made by the student in the home workshop with relatively simple tools and represents a device useful for many experiments. Galvanometers are not useful for measuring alternating current because they contain a permanent magnet. Fig 56 shows basic elements of a galvanometer.

Simple Direct Current Instruments

FOR practical direct current measurements the most popular type of instrument is that known as the **D'Arsonval movement.** In principle, the D'Arsonval type direct current movement is identical to that of the galvanometer previously explained. It consists of a permanent magnet, a moving coil, a soft iron core for concentrating the flux through the coil, and a suitable shaft on which the coil is mounted.

The principle difference between the D'Arsonval type direct current movement and the galvanometer as used in laboratories and schools is in the method of suspension. The galvanometer coil suspension generally consists of a fine phosphor bronze wire, and in the D'Arsonval movement the coil is attached to a rigid shaft turning in jeweled bearings. The advantage of the D'Arsonval movement is its greater ruggedness, its ability to return to zero setting when current is removed, and its small compact size.

Theory of D'Arsonval Movement

THE theory of the D'Arsonval type movement is readily understood by reference to Figure 57 which shows how the moving coil is positioned between the permanent magnet pole pieces when no current is flowing through the coil.

When current is passed through the coil, the electro magnetic field created around the coil tends to line up with the permanent magnetic field causing the coil to turn so that the maximum number of lines can pass through it. The direction of coil rotation depends upon the direction in which current passes through it. If incorrectly connected to the source under measurement it will read backwards; that is, the needle will deflect off scale. Current is led into the coil via tiny phosphor bronze springs located on each end of the coil.

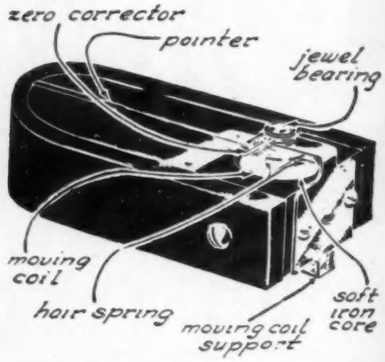


Fig. 57. — Schematic of D'Arsonval type movement

The name D'Arsonval, which is applied to instrument movements, is the name of its original inventor.

Difference Between Ammeters and Voltmeters

FOR the **measurement of the current flow** in an electrical circuit we use an instrument known as an **ammeter,** and for the measurement of the **voltage (pressure) across the circuit,** we use an instrument known as a **voltmeter.** The chief difference between ammeters and voltmeters lies in their resistance. Figure 58 shows schematically the essential difference between voltmeters and ammeters. Ammeters have quite low resistance and can be connected directly in the circuit while voltmeters have high resistance and are therefore connected across the circuit.

The internal structure and elements of ammeters and voltmeters are almost identical; that is, they often have the same type coil and the difference between them comes in the provision of series resistances in the voltmeter coil circuit, and in providing what are known as **shunts** in the ammeter circuit.

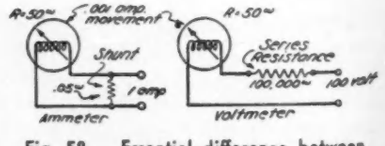


Fig. 58. — Essential difference between ammeters and voltmeters

Purpose of Shunts

A SHUNT is merely a low resistance wire composed of a special alloy known as **manganin.** The moving coil of the meter is shunted or connected directly across the terminals of this low resistance unit so that while the bulk of the current flows through the resistor itself some of it is by-passed through the meter. Thus, the sensitive meter is able to record the total current flowing through the circuit inasmuch as "the current through the meter is directly proportional to the current through the shunt." The meter dial is calibrated so that it reads the current flowing in the line.

The voltmeter which has a high resistance connected in series with its moving coil is so designed that the resistance limits the total current flowing in the meter to a value which gives full scale deflection for the full range voltage.

Danger to Meters

ONE of the most important things to remember in using electrical testing instruments is to **never connect an ammeter across a circuit,** as to do so would immediately burn it out. Ammeters are exceptionally low resistance devices **intended for connection in series with the circuit** and not in shunt or parallel. On the other hand, if a voltmeter should accidentally be connected in series with a circuit rather than across the circuit no harm will ordinarily result to the voltmeter although the normal operation of the circuit might be interferred with due to the high resistance of the voltmeter limiting the current flowing in the circuit to a small value. Fig. 60 illustrates this important feature in the handling of meters.

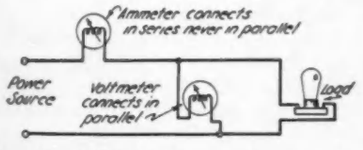


Fig. 60. — Method of connecting ammeters and voltmeters in the circuit

Practical Measuring Instruments

DIRECT current instruments of the D'Arsonval type are available for current measurements in ranges extending from as low as 0 to 15 microamperes to ranges of several hundred amperes. Voltmeters of this type are available in ranges which extend as low as a few millivolts to those capable of measuring several kilovolts. Fig. 61 shows one type of D'Arsonval meter.

Fig. 61. — A typical D'Arsonval meter

Polarized Vane Type Movements

THE instrument used for measuring the charging current on automobile storage battery systems consists of what is known as a **polarized vane type movement.** These instruments consist essentially of a fixed coil, which is generally a single turn of large size copper wire in ammeters, and a small soft iron vane attached to an indicating needle which is arranged on a pivoted shaft so that the vane normally lies at right angles to the magnetic field created when current is passed through the coil. A small permanent magnet located near the soft iron vane "polarizes" (that is, induces magnetism in the soft iron vane) the vane so that when current is passed through the coil, the vane tends to align itself with the flux created in the coil, thus moving the indicator needle over a calibrated scale. Figure 62 illustrates schematically the principle of this type meter.

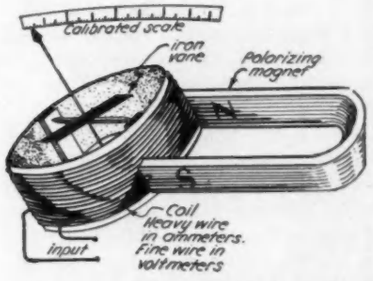


Fig. 62. — Principle of polarized vane type movement used in inexpensive meters

Instruments of this type are not highly accurate and give only an approximate indication of the current or voltage conditions in a circuit and are not recommended where accurate readings are required. The only difference between ammeters and voltmeters in the polarized vane type movement is in the number of turns of wire on the fixed coil. Ammeters have only a few turns of heavy wire and voltmeters a large number of turns of fine wire.

Fig. 63.—Well designed polarized vane type meter (Courtesy Readrite Meter Works)

One of the large instrument companies manufactures instruments of this type which have a fair accuracy and which are quite cheap. For rough work they are well suited. Fig. 63 shows one of the best of the polarized vane type instruments.

Note.—The theory and use of A.C. instruments are discussed in a later section of this course.

Fuse Protection for Meters

TO AVOID damaging the sensitive movements of delicate meters, fuses have been developed which can be inserted in series with the meter and thus prevent damage if the meter is incorrectly connected in the circuit. These fuses are available in sizes ranging from .005 ampere to several amperes. They are manufactured by the Littlefuse Company of Chicago. Fig. 64 shows one of these fuses together with a fuse holder.

Fig. 64. — Instrument protective fuses

The wire from which the smallest of these instrument fuses are made is 30 times finer than a hair. One pound of this wire would reach 25,100,000 feet. Instrument fuses are made in capacities of one two-hundredth, one-hundredth, one-thirty-second, one-sixteenth, one-eighth, one-fourth, three-eighths, one-half, three-fourths, and 1 ampere capacities.

Resistance Measuring Instruments

IN WORKING with electrical circuits and apparatus, we often need to know the resistance of either a piece of apparatus or of the line wires of the circuit. This is an important phase of testing work. The two principal means of measuring resistance are by means of (1) a **Wheatstone bridge** and (2) a **direct reading ohmmeter.** The direct reading ohmmeter is the most common method employed for ordinary work.

The Wheatstone Bridge is a very precise method and is used where high accuracy is necessary, as, for example, in certain types of fault location work in telephone systems and in highly accurate laboratory work.

The Direct Reading Ohmmeter

THE direct reading ohmmeter consists essentially of a D. C. voltmeter operated in series with several dry cells or a "B" battery. In operation, the resistance to be measured is connected to the external terminals of the ohmmeter. This offers a path for

(Please turn to page 46)

Outside Storage of the

Telephone Company's Coal Reserves

Advisability of Starting It During the Favorable Weather Months.

By THOMAS HERDMAN

"JUST dump it any place vacant in the yard," is, more often than not, the very casual instruction the coal delivery man receives when the fuel bins inside the telephone building are already filled to the brim. The wise telephone company manager staggers his wartime coal purchases to be reasonably sure of adequate reserves for the winter months.

Outside storage of coal, from an efficiency standpoint, is not a happy-go-lucky procedure. In Britain definite rules have been formulated from wartime fuel conservation experience and research.

The Fuel Research Station of the British Ministry of Fuel and Power has influenced British institutional, industrial and commercial users to consume LESS coal and at the same time obtain MORE heat value.

First and foremost, no outside coal storage pile should exceed 200 tons. Neither should aforesaid pile rise higher than ten feet from the ground. An eight feet maximum is even safer. The reason for these precautions is that coal must have scope to breathe. Coal deterioates faster when stifled for air. Spontaneous combustion is a strong possibility when the storage tonnage is in excess of 200, or the pile towers above ten feet. Rarely does spontaneous combustion occur when these safety limitations are observed.

THE ideal location is a piece of cleared ground, free from rubbish or weeds, and not altogether shut in by buildings or blank walls or fences, all of which retard ventilation. The best ground surfaces, in the order named, are stone, cold ashes (well-rolled), hard clay, chalk, peat (if first packed several inches deep with cold ashes or ballast).

On the other hand, the worst possible depository is that near a source of artificial heating—a boiler house wall, or some steam pipes, or any covered carrier of a warm fluid such as organic waste.

Each kind of coal should be stored in a separate stack, as climatic reactions vary with the size of coal. Generally speaking, smaller coals disintegrate more than larger coals. Since coal is purchased in a size suitable for a specific commercial or industrial use, any change in that size as the aftermath of outdoor storage will reduce heating efficiency.

Anthracite (hard and dull) is safer to store in large quantities than Bituminous (soft and shiny). The British Fuel Efficiency board lists their deterioration ratio, from highest to lowest, in this order: Lignitic, sub-bituminous, bituminous, semi-bituminous, anthractic, anthracite.

A noticeable change is that a bright coal like bituminous turns dull or rusty. It acquires such inorganic constituents as pyrites and ankerite. However, the fuel is just as good as before it was stored, although the changed condition is favorable to disintegration.

The softer and larger the coal, the easier for climatic exposure to break it into smaller pieces.

The harder and larger the coal, the slower it deteriorates.

While a coal never crumbles to dust, it tends to become brittle after outdoor storage. Each handling produces increased breakage. A sound rule to follow is to never disturb a storage pile unless you have immediate need of the fuel.

DIGGING into the coal reserve pile during the first three months is inadvisable except in an emergency. To leave it untouched six months or longer is preferable. Deterioration is more extensive during the **first** three months of outside storage. It then slows down considerably.

The advantage of starting a coal storage pile in the favorable weather months is that disintegration is lower than in winter.

Instead of drawing upon the stored pile for immediate fuel needs, use the supply of coal just delivered. One advantage is the labor saved in not having to handle the fuel twice. The other advantage is that this new coal, because it is going to be consumed right away, avoids the **high** deterioration period of outdoor storage.

Normal losses from stored coal average between one-half percent and one percent yearly.

HOW much coal can be stored if space is limited in the toy factory yard? A British ton of 2,240 lbs. requires from 40 to 50 cubic ft. If kept to the ten feet high maximum, 1,000 British tons require a base 80 ft. square. At the top, with the sides sloping at 45 degrees,

it will be 60 ft. square.

How is the steam-rising power of stored coal affected? The external difference in the moisture content may mistakenly reflect a decreased caloric value. There will also be the crop of disintegrated small coals slipping through the grate. As a matter of fact, neither condition materially reduces the steam-rising power.

To guard against a fire occurring by spontaneous combustion, the coal storage location should be one where there is access to an adequate supply of water. It takes more than a fine spray from a hose to douse such a fire. Not only are lots of water needed, but it is also essential to attack the seat of the fire by holing, trenching and cutting. Another tactic is to spread the pile so that the hot coal gets a chance to cool.

Traveling Exhibit Shows Restoral Methods During Wartime

First on the scene is a "field supervisor" who reaches one of the testboards over a talking circuit that is a part of the gas-pressure alarm system. This enables the testboard to start the repair crews on their way.

A traveling exhibit, the purpose of which is to demonstrate to telephone field crews the latest methods for the speedy restoral during wartime of disrupted telephone circuits, is now touring Albany, Syracuse and Buffalo after an extended engagement at the New York Telephone Company's headquarters building, at 140 West Street, New York City.

The demonstration is the result of intensive study by the Long Lines Department of the American Telephone and Telegraph Company of how to make rush repairs to circuits crowded with essential war calls. In the past it has been possible to restore service quickly over spare facilities or alternate routes. Few spares are available today, and alternate routes are also crowded with calls. The emphasis is being placed on the speedy repair job as, in many cases, this may be the only way out in an emergency.

Using an actual telephone cable, reclaimed from the salvage pile for the purpose, the demonstration crew of splicers and their helpers, testboard men, linemen and supervisors—all veterans of the Long Lines plant department—show to their audiences how a severed cable is restored in double-quick time.

At the start of the demonstration the cable, carrying live talking circuits between two demonstration testboards, is severed with cable-cutting shears. News of the damage is immediately reported to the repair forces. The demonstration crews go into action and the hundreds of circuits in the severed cable are tested to determine the extent of the damage and the location of the trouble. This takes a matter of minutes, and then circuits carrying especially vital services are swiftly rerouted.

A type of telephone wire known as a twisted pair is used to bridge the gap in the circuits, being spliced at each end to wires in the cable. This serves until permanent repairs can be made by splicing a section of cable into the damaged section.

A splicer twists the repair circuits onto the wires at end of the break while his helper tests them through to the testboard.

WAACS Do Outstanding Communications Job

During the battle of Tunisia WAACS who handled switchboard and teletype operation did a "bang-up job" Colonel Floyd T. Gillespie, Assistant Chief Signal Officer in the North African Allied Fore Headquarters reported recently to the War Department.

"Every one of the girls released some man for Signal Corps duty up in the combat zones," Col. Gillespie said, "and after a few weeks experience in their jobs, they were handling their assignments like veterans. The manner in which they picked up the work was outstanding. They were fast and accurate, and we were getting as good service as that which we get here in this country."

Col. Gillespie noted that some of the WAACS who spoke French were used for liaison work with operators of the French telephone company.

"We could have used hundreds more," he added. "In fact, had we had enough of them, we could have used them to operate all our fixed communication installations — telephone and telegraph — throughout the rear areas."

Col. Gillespie is now back at the War Department in the Office of the Chief Signal Officer in charge of the Military Training Division. Because of his experience in the North African theatre of operations this background is viewed as particularly valuable for future combat training of Signal Corps troops. He succeeded Col. Louis Kanzler, who has been assigned to other duties.

Ants Hazard Poles

White ants in Australia provide difficult hazards for telephone construction, so Major Jack Lea, formerly of the Information Department of the American Telephone and Telegraph Long Lines Department who is now in the Signal Corps in the "land down under." Major Lea's experiences are recited in the July issue of the Long Lines Magazine.

While the U. S. Army is constructing telephone lines in areas of Australia which never saw a pole before, Major Lea wrote that the poles had to be metal ones. Otherwise, a pole line of wooden poles and crossarms would be completely devoured by the white ants in four months time. The curious Americans in the Signal Corps had to be "shown" and put in one wood span near the regular line of metal poles and Major Lea reported "sure enough all we found later were the glass insulators, wire, bolts and braces and the empty holes."

★
AN ENGINEERING ARTICLE
★

Calculation of Resistance Networks

By L. S. UPHOFF
State Office Bldg., Albany, N. Y.

General

EVERY profession has its window dressing. A customer may look over the rows of stock bottles in a drugstore all neatly labeled to indicate the contents but who would suspect that a high sounding label like "Hamamelidis Foliorum Extractum" was merely the witch-hazel commonly used after shaving?

Engineers often use mathematics for window dressing. While mathematics is extremely valuable to the engineer, it is frequently the stumbling block which prevents the practical worker from applying the formula which the engineer has worked out.

A simple relation expressed as a mathematical formula appears scientific (especially if a few Greek letters are chosen for symbols) and it may serve to enhance the reputation of the writer, but if the practical worker can't understand it, the useful results which should follow are lost.

The purpose of this article is to make a small contribution toward simplifying the calculation of resistance networks. The data herein will enable anyone who can multiply, point off decimal places, and divide by 2, to design resistance networks (for use between equal impedances) which will give a loss of any desired number of decibels up to 48. Formulae is also given so that anyone who can substitute values therein and take the square root of a number can design resistance networks for use between unequal impedances.

The Resistance Network

THE resistance network is an extremely handy device for telephone transmission work. It can be made up in a few minutes if the proper resistances are available, has no moving parts, can be made small in size and light in weight, and seldom gets out of order. By its use, a definite and known transmission loss may be introduced into a circuit where required without producing impedance mis-

(Please turn to page 52)

TABLE I

FACTORS FOR CALCULATING

"T" type Networks for Use between Circuits of Equal Impedances.

db	Series Arm Factor	Shunt Arm Factor	db	Series Arm Factor	Shunt Arm Factor
1	.0575	8.6709	25	.89358	.11384
2	.1146	4.3040	26	.90458	.10122
3	.1710	2.8392	27	.91442	.09012
4	.2262	2.0969	28	.92344	.08011
5	.2802	1.5446	29	.93143	.07136
6	.3323	1.3387	30	.93873	.06345
7	.3825	1.1161	31	.94518	.05654
8	.4305	.9265	32	.95099	.05037
9	.4806	.8118	33	.95620	.04487
10	.5195	.7027	34	.96088	.03996
11	.5603	.6122	35	.96506	.03561
12	.5985	.5362	36	.96879	.03173
13	.6341	.4714	37	.97215	.02826
14	.6674	.4155	38	.97494	.02540
15	.6981	.3672	39	.97781	.02245
16	.7264	.3252	40	.98020	.02001
17	.7525	.2881	41	.98234	.01783
18	.7764	.2559	42	.98425	.01588
19	.7982	.2273	43	.98594	.01416
20	.8182	.2020	44	.98746	.01262
21	.8364	.1796	45	.98882	.01124
22	.8529	.1598	46	.99003	.01002
23	.8678	.1423	47	.99110	.00894
24	.8813	.1267	48	.99207	.00796

or Peace—
Helping Win a War!

Designed for peace, Strowger Automatic telephone equipment is serving the purposes of war on every front. With nearly all of our production now being used directly or indirectly in the war effort, equipment produced during more peaceful times is helping win the battle here at home! Here are some of the ways it serves:

WITHIN WAR INDUSTRIES:

Automatic Electric's private dial telephone equipment is helping hundreds of war plants produce more battle materials, faster. . . . Executives and workers are kept in instant touch with one another—time is saved in every department—important production speeded up—all through fast automatic intercommunication!

BETWEEN WAR INDUSTRIES:

Through Strowger Automatic public exchanges in every part of the country, messages shuttle day and night—speeding the flow of raw materials—coordinating the work of contractors and sub-contractors—promoting greater speed and efficiency in meeting the interlocking requirements of supplier, producer and the ultimate consumer, America's fighting forces.

IN TELEPHONE EXCHANGES:

Here Strowger Automatic equipment helps by handling peak loads with amazing flexibility; requiring a minimum of maintenance attention; lending itself to rearrangement to meet changing traffic needs; and freeing hands and arms of trained workers for the countless war tasks that machines cannot do.

IN HOMES:

Because of its long life and dependability, Strowger Automatic equipment is keeping telephone service at normal levels in thousands of American homes—maintaining morale for factory and farm workers who know their vital calls will always get through.

AUTOMATIC ELECTRIC

ORIGINATORS AND DEVELOPERS OF STROWGER STEP-BY-STEP MACHINE SWITCHING AUTOMATIC DIAL SYSTEMS

MAKERS OF TELEPHONE, SIGNALING AND COMMUNICATION APPARATUS
ELECTRICAL ENGINEERS, DESIGNERS AND CONSULTANTS

Distributors in U. S. and Possessions:
AUTOMATIC ELECTRIC SALES CORPORATION, Chicago, U.S.A.
Export Distributors: INTERNATIONAL AUTOMATIC ELECTRIC CORPORATION

YOU GET

FULL PROTECTION AT EVERY POINT

TYPE 15 SUBSTATION PROTECTOR
TYPE 40 PROTECTED CABLE TERMINAL
TYPE 20 SUBSTATION PROTECTOR
TYPE 35 PROTECTED CABLE TERMINAL

with

Automatic Electric

PROTECTIVE APPARATUS

Not only are Automatic Electric protective devices built to give you a wider range of protection throughout your plant but this equipment also gives you a greater measure of protection at each specific danger point. This is because Automatic Electric substation protectors and protected cable terminals are engineered to offer maximum protection against dangerous forces. For example: the Type 20 Substation Protector has a ¾-inch air-gap between every terminal point and the metal cover. This provides an additional guard against high potentials.

In the long run you'll find that Automatic Electric apparatus gives you ***more*** protection, ***more*** economically than any other line of protection equipment. For further information write for Catalog 4068-A.

AUTOMATIC ELECTRIC

ORIGINATORS AND DEVELOPERS OF STROWGER STEP-BY-STEP MACHINE SWITCHING AUTOMATIC DIAL SYSTEMS

MAKERS OF TELEPHONE, SIGNALING AND COMMUNICATION APPARATUS
ELECTRICAL ENGINEERS, DESIGNERS AND CONSULTANTS

Distributors in U. S. and Possessions:
AUTOMATIC ELECTRIC SALES CORPORATION
1033 W. Van Buren St., Chicago, U. S. A.
Export Distributors: INTERNATIONAL AUTOMATIC ELECTRIC CORPORATION

25 YEARS AGO THIS MONTH

Taken from TELEPHONE ENGINEER files of August, 1918.

The August, 1918 issue of TELEPHONE ENGINEER mentioned that a telephone was installed in the State Council of Defense building in Chicago, and lettered on its base on a silver plate were the following words: "The 500,000th telephone in the city of Chicago, installed this day for Samuel Insull, chairman State Council of Defense of Illinois, July 30, 1918.

★

That housing shortage in Washington, D. C. was almost as acute 25 years ago as it is today was indicated in the announcement by the Chesapeake and Potomac Telephone Company of the purchase of two apartment houses in that city for use as hotels for their employees.

★

Independents granted commissions in a 1918 Signal Corps recruiting drive by their industry included: Majors Gustav Hirsch, Columbus, Ohio; E. O. Baker, Paris, Ill., and Clair J. Shands, St. Louis, Mo. Captains Albert F. Combs, Philadelphia, Pa.; A. B. Sperry, New York City; B. G. Kelly, Philadelphia, Pa.; Donald Robinson, St. Paul, Minn., Terry W. Allen, Corinth, Miss., and Geo. W. Dickerson, Galion, Ohio.

★

At the Arkansas Telephone Association meeting of 25 years ago the necessity for a general increase in telephone rates was discussed and it was unanimously agreed that all the companies must have more revenue to offset the increasing prices of materials and labor. F. B. Sprague of Conway presided as president.

★

John A. Campbell of Columbus, Ohio was in August, 1918 appointed manager of the Ada Telephone Company, Ada, Ohio.

★

Twenty-five years ago 27 managers of the National Telephone and Electric Company offices were in Clinton, Ill., where they were called by the general manager, E. S. Sterrett of Henry, Ill., to attend an anchor demonstration given by the Chance Manufacturing Company.

Clarence E. Jones

Clarence E. Jones Named

Clarence E. Jones, Chief Engineer of the Pennsylvania Telephone Corporation, who has been advisor to WPB Communications Division Director Leighton H. Peebles since last April 1, was elected July 28 Vice-President of that company. He also was designated a member of the Board of Directors.

Mr. Jones has been the Chief Engineer of the Pennsylvania Telephone Corp. since 1929 when it was founded. Prior to that from 1924-1929 he had been the Chief Engineer of the Portsmouth, O. Home Telephone Co. During the preceding three and one-half years he served as the telephone engineer in charge of field work from 1922-26 with the Ohio Public Utilities Commission. He had been for twenty years with the Ohio Bell Telephone Co. prior to going with the state commission, having risen from installer to district engineer.

Completes Purchase of Indiana Exchanges

Officers of the Eastern Indiana Telephone company of Winchester, Ind., July 9, announced purchase of the Green's Fork Cooperative Telephone company, operating exchanges at Green's Fork and Williamsburg in Wayne county. Purchase price was $22,000.

Acquisition of these two exchanges brings to 17 the number now operated by Eastern Indiana, others being at Winchester, Farmland, Parker, Dunkirk, Redkey, Ridgeville, Saratoga, Lynn, Fountain City, Economy, Modoc, Losantville, Hagerstown, Centerville and Cambridge City.

Sale and purchase were approved recently by the Indiana public service commission, the purchase including assets and not the common stock. The Green's Fork company will be dissolved, it was said.

Three hundred and fifty telephones were involved in the transaction.

Eastern Indiana already has improved the Green's Fork exchange, remodeling the interior of the building, changing the switchboard, installing new terminal racks and improving the cable system.

Idle Facilities Eligible For Use in Elections

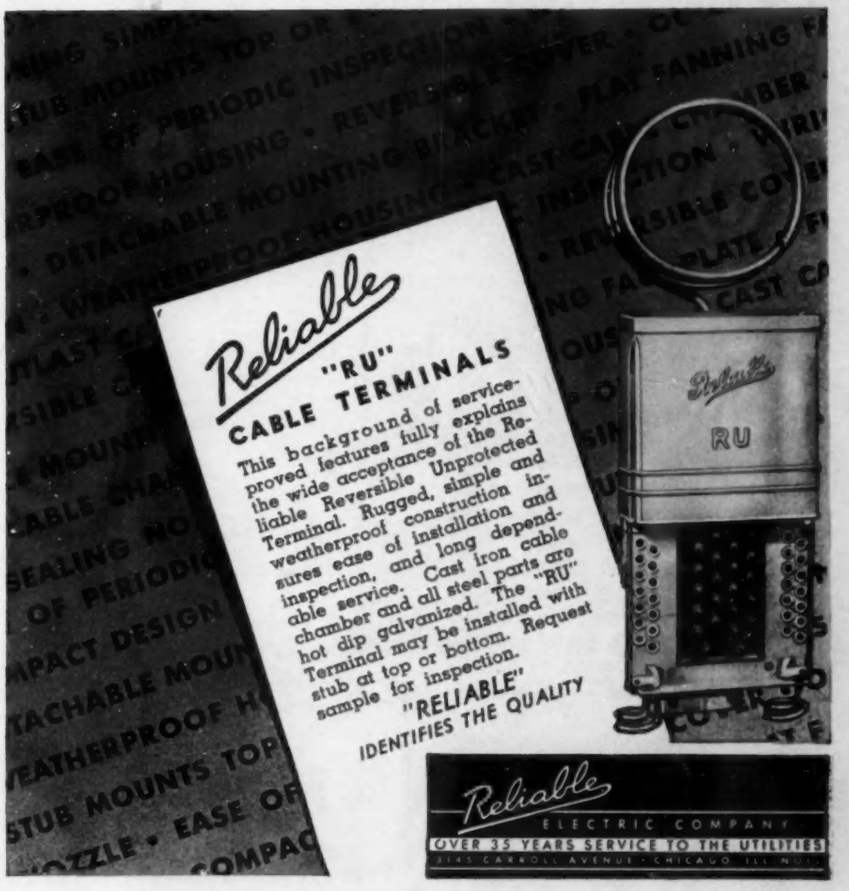
The United States Independent Telephone Association on July 13th filed on Form PD-761 an appeal with the Communications Division of the WPB requesting relief from paragraph (e) (1) (i) of Order U-2. The appeal asked that telephone companies be permitted to use idle facilities, reserved for either Schedule A users or for public pay stations, in order to serve national, state, county and municipal election campaign offices, or a candidate for election. The Bell System filed a similar appeal.

Such telephone service is ordinarily required for only a short period of time, usually not more than 90 days. Experience indicates that it would be difficult to conduct election campaigns without a telephone and that the best interests of the community would be served by providing such telephone service. There is also the possibility of embarrassment to a telephone company if it denied service to political groups while holding idle facilities for Schedule A users.

These appeals were granted on July 20th, and all telephone companies may now treat requests for service of the type indicated on the same basis as any Schedule A subscriber. It should be understood, however, that the granting of the appeals by the Communications Division does not carry with it permission to make additions to exchange line plant or central office equipment, regrade service, or disconnect interim service. If idle facilities are not available and additions must be made, it will be necessary for the individual company to file an appeal with the Division.

Pigeon for Telephone

Pigeons work for the Army communications men, right along with the telephone, and do right well. A pigeon on a 90-mile flight in French Morocco was shot through the craw and wing, but delivered the message. A solicitous sergeant sewed up the wounds, made by a hunter's birdshot, and said the patient would pull through.


Reliable
"RU"
CABLE TERMINALS
This background of service-proved features fully explains the wide acceptance of the Reliable Reversible Unprotected Terminal. Rugged, simple and weatherproof construction insures ease of installation and inspection, and long dependable service. Cast iron cable chamber and all steel parts are hot dip galvanized. The "RU" Terminal may be installed with stub at top or bottom. Request sample for inspection.
"RELIABLE" IDENTIFIES THE QUALITY
RU
Reliable
ELECTRIC COMPANY
OVER 35 YEARS SERVICE TO THE UTILITIES

YOUR QUESTIONS ANSWERED FREE

Line AND Desk

Q. When and where should grade clamps be placed in a cable lead?

A. At locations where the cable grade exceeds five feet in 100 feet. The number and spacing of the clamps depends upon the length and steepness of the grade itself. In general a grade clamp at every two to six poles is sufficient, but if the grade exceeds 15 feet in 100, one clamp at every pole may be needed. The first clamp should be placed at the top pole on the grade. Each clamp should have a lead bushing (made from scrap sheath) to protect the cable from direct contact with the clamp. A grade clamp at a cable corner is necessary especially if the cable slopes away from the corner.

Q. We have been experiencing trouble with pole brackets pulling out on dead ends. We tie them down with bridle wire, but this method doesn't always work. What method would you recommend to hold the brackets in place?

A. Special bracket clips are available for reinforcing pole brackets at corner or dead-end points. As shown in Figure 2, there are two sizes of the clip in a pair, the top one being designed to go over the pole bracket at the position of the upper nail, while the other fits over the bracket at the head of the lower nail. ¼" x 2" fetter drive screws are used to secure the clips to the poles.

Q. Whenever we wish to reuse an instrument cord salvaged from another telephone set, we sometimes find the tie string broken off or the cord hook missing. What is a good way to attach a new tie string?

A. A good method that we know of is to make use of cotton braiding stripped from discarded instrument cords. Conductor braiding makes the best tie string material. To attach the braiding to cords, we recommend the method illustrated in Figure 1. Make a loop with a length of cotton braiding 12 to 15 inches long as shown in Figure 1 (a), holding the tie string and cord together at "1" with the thumb and forefinger of the left hand and the portion of the loop "2" with

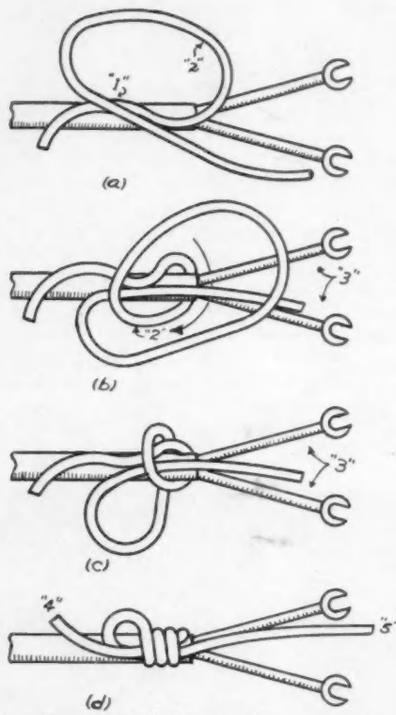


Fig. 1. — Method of attaching a new tie string to an instrument cord.

the right hand. Pass this portion of the loop around the cord in the direction of the arrow in Figure 1 (b). Make one complete turn with portion "2" of the loop, allowing the conductor ends "3" to slip through the loop as shown in Figure 1 (c). Make three complete turns with the loop as in Figure 1 (d), and draw ends "4" and "5" of the braiding taut. Cut off end "4" close to the tie and trim end "5" to the desired length to serve as a tie string.

Q. On a 20 wire lead, how far can the circuit on pin position 1-2 and 9-10 go without being transposed with respect to each other? That is without having transpositions which would in effect result in a transposition between the two circuits?

A. Because of the shielding effect of intervening wires these circuits could parallel each other for as much as 50 miles before reaching the objectionable cross-talk limit.

Q. Please tell us how we can satisfactorily restore the finish of molded plastic parts of telephone sets.

A. The most effective method of restoring the original finish of black bakelite parts is to buff the parts on a high speed motor with a sewed cotton buffing wheel. It is very important to use the right kind of buffing compound. Two kinds are generally used, one coarser and more abrasive than the other to remove deep blemishes in the bakelite surface, and the other, made of fine, chalk-like material, to polish the surface. When two kinds of compound are used, it is necessary to employ two different buffing wheels, one for each kind of compound. Colored plastic parts are more difficult to polish properly and may require scraping and sandpapering to remove deep set blemishes. The proper kinds of buffing compounds can be obtained from companies specializing in the manufacture of buffing equipment.

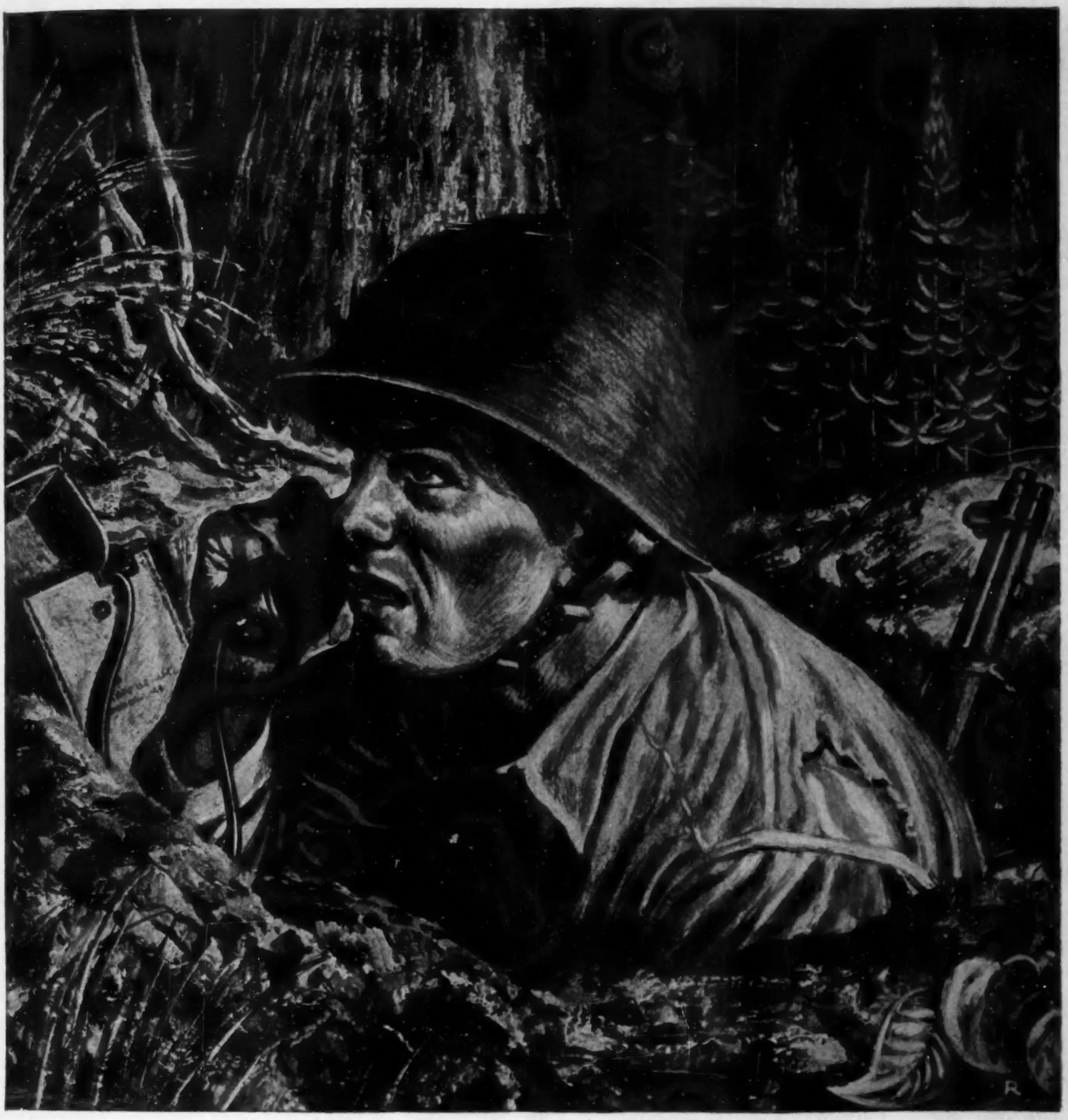
Q. We have accumulated several hundred main and receiver cords on which the braid is badly worn, though the conductors are still good. Should these cords be sent to the scrap pile or is it possible to rejuvinate them?

A. Good cords with worn braid certainly should not be discarded. There are several well-known cord manufacturers who have facilities for rebraiding any type of instrument cords at very reasonable cost. It is recommended that worn cords be tested for noise and broken metal clips or tips be repaired or replaced before the cords are sent to the factory for rebraiding.

Questions Answered FREE

We welcome questions from every reader. If quick direct mail reply is needed please enclose stamped addressed envelope.

Every branch of the Armed Services uses the telephone. No. 5 of a series, Marine Corps.



WON'T YOU HELP HIM OUT?

Johnny is one of millions in the armed forces who must have equipment that only *your* dollars can buy. Not just a few dollars now and then—but *regularly—every dollar you can possibly invest in War Bonds from now till Victory!*

Some day Johnny, front line observer, will climb out of his last foxhole into a world freed from fear of dictators. When that day comes, the telephone—now speeding commands on the battle-front and production on the home front—will help to place all people of the earth on friendly speaking terms.

Western Electric

IN PEACE...SOURCE OF SUPPLY FOR THE BELL SYSTEM.
IN WAR...ARSENAL OF COMMUNICATIONS EQUIPMENT.

Personalities

Calvin Stegmeier, has purchased the Hail (N. Dak.) Telephone Co. from Mrs. Nellie Schultz.

●

Dillard Ray, president of the Folsondale Telephone Company, Hickory, Ky., and serving as lineman for the company was killed instantly June 17 while he was climbing a broken telephone pole and came in contact with a high tension wire. He was repairing storm damage.

●

Clyde B. Calhoun, of Zanesville, district commercial manager for The Ohio Bell Telephone Company's Zanesville district, has been elected president of N. C. Kingsbury Chapter, Telephone Pioneers of America, which covers all Ohio Bell territory.

●

The recent California convention gave your Editor a chance for some real cooperation with **Grant Smith,** of the Associated Telephone Company, Ltd., who handled the story for us. We were glad we had the opportunity of returning his favor by airmailing him a bit of information for the coming copy of Associated Circle, the company magazine he so ably edits.

●

Russell M. Peterson, district manager at Barry, Ill. of the Pike County Telephone Company has resigned his position and has accepted a new place in the maintenance department of the National Trail Telephone Company, Altamont, Ill.

●

C. L. Lisle, maintenance superintendent of the Mansfield (Ohio) Telephone Company, has not been happy of late. An electrical storm that struck Mansfield July 17 put approximately 600 phones out of service. This was the sixth electrical storm they have had this year and about 2,500 instruments have been out of service during that time. About 400 of the instruments have been burned out, he told newspapers.

Captain George S. Blake, 217 Signal Depot Company, has notified us of his successful arrival in the South Pacific. His company was sponsored by the Associated Telephone Co. Ltd. George has a new mailing address and number. Friends may address him as Capt. George S. Blake, 0-477520, 217th Signal Depot Company, A. P. O. 709 c/o Postmaster, San Francisco, Calif. Our letter came V-mail and was delivered very promptly. We sent him several copies of the July 15 number as he wanted to get our report of the California convention for his group.

●

H. G. Meyer, manager of the Victor (Ia.) Mutual Telephone Company for the past 13 years has resigned.

●

Karl J. Aulerich has been made manager of the Tama and Toledo, Iowa, exchanges of the Central Iowa Telephone Company. He succeeds **M. D. (Mike) Agena,** manager for the past 5 years.

●

Merrick Jackson, editorial director of the Western Electric Company, was elected president of the National Council of Industrial Editor's Associations at a recent wartime conference of this group.

●

Harry B. Gilmore, secretary of the Western Electric Company, will retire September 1st after 41 years of service, it was announced recently following a meeting of the Company's directors. **Norman R. Frame,** assistant secretary, was elected secretary by the directors to succeed **Mr. Gilmore.**

●

Rexford Tugwell, head of the government of the island of Puerto Rico, is negotiating with heads of the International Telephone and Telegraph Co. for governmental purchase of the telephone system of the island. The system operates under the name of the Puerto Rico Telephone Co. and was one of the first subsidiary companies of the International group. Mr. Tugwell desires to socialize all utilities and he plans to have a government appraisal of the insular telephone plant and proposal to purchase before September of 1944. **Colonel Sosthenes Behn,** head of the I. T. & T. Co., returned recently from Puerto Rico and conferred with President Roosevelt at Washington..

●

Charles P. Cooper, vice president of the American Telephone and Telegraph Company, New York, was elected in July president of Presbyterian Hospital and its allied institutions at a meeting of the board of managers.

●

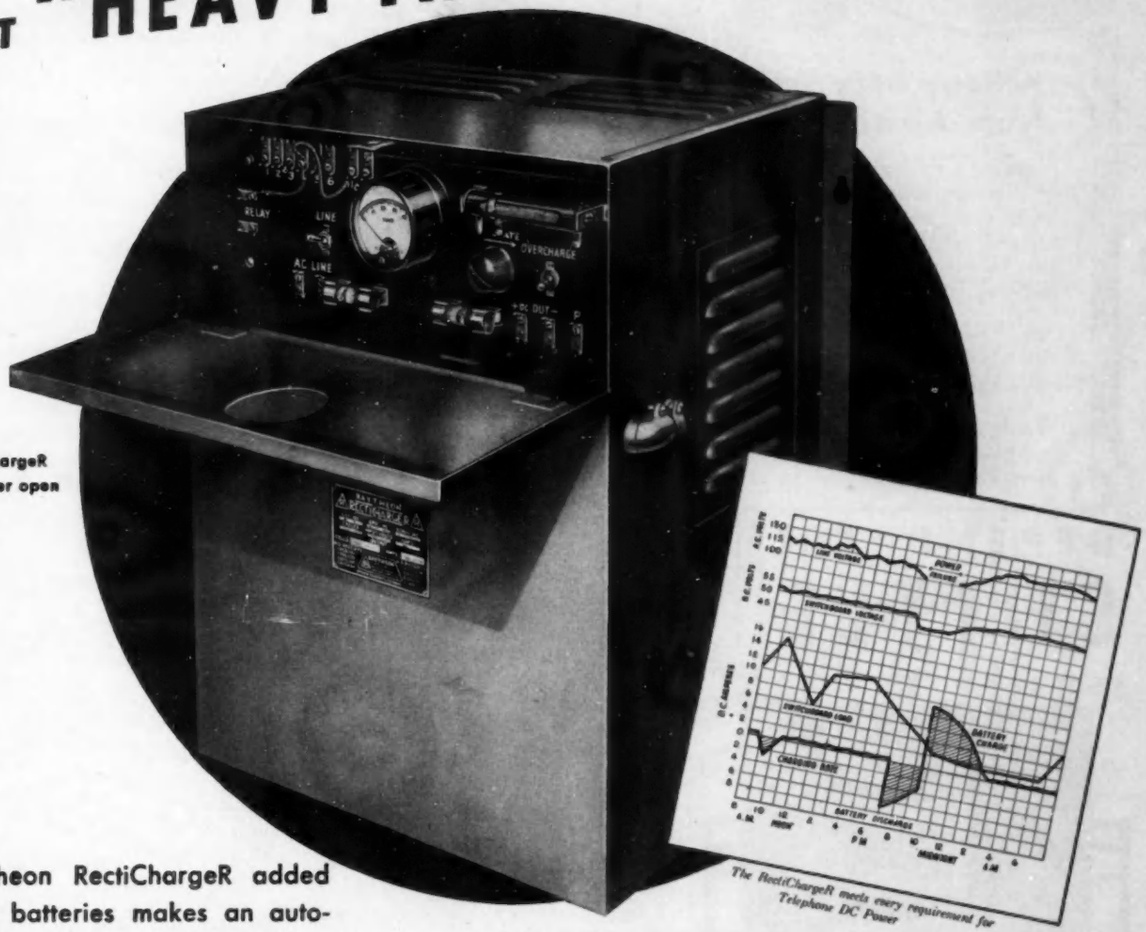
Ormond R. Bean, former Public Utilities Commissioner of Oregon from 1939 to June, 1943, was appointed last fortnight Regional Director of the Office of Defense Transportation for the Territory of Hawaii. In announcing the appointment, ODT Director **Joseph Eastman** revealed that **Mr. Bean** will leave for his headquarters in Honolulu early in August.

●

L. E. Proctor is the new manager

RAYTHEON RECTICHARGERS

MEET "HEAVY TRAFFIC" POWER DEMANDS



RectiChargeR with cover open

The RectiChargeR meets every requirement for Telephone DC Power

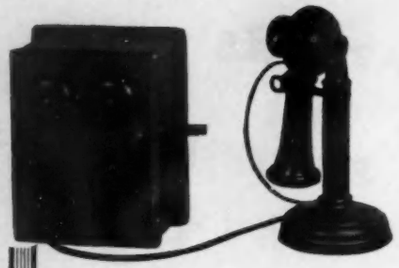
A Raytheon RectiChargeR added to your batteries makes an automatic AC to DC power system that meets war time "heavy traffic" power requirements. You simply plug the RectiChargeR to the AC input and connect the output to the batteries . . . adjust the charging rate . . . then close the cover and forget it. From there on the Raytheon RectiChargeR automatically takes care of the system. Write for bulletin, today.

7 Points in Your Favor

1. RectiChargeRs keep batteries fully charged.
2. RectiChargeRs prevent overcharge and undercharge.
3. RectiChargeRs prevent frying transmitters, sticking relays and poor ringing.
4. RectiChargeRs eliminate voltage variations.
5. RectiChargeRs increase lamp and battery life.
6. RectiChargeRs are entirely automatic . . . having no moving parts . . . require no maintenance.
7. RectiChargeRs reduce battery maintenance and inspection to once or twice yearly.

The coveted Army-Navy "E" for Excellence in the manufacture of war equipment and tubes flies over all four Raytheon Plants where 12,000 men and women are producing for VICTORY.

RAYTHEON MANUFACTURING Company
190 WILLOW ST WALTHAM, MASS.



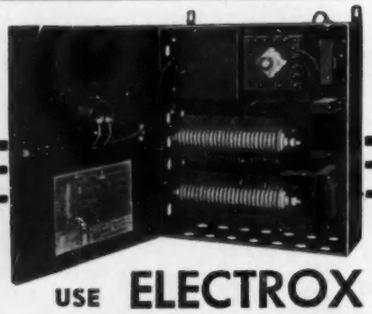
Kellogg Desk Sets Now Available

A recent arrival of a good stock of Kellogg Desk Stands and other parts enables us to offer remanufactured Kellogg Desk Sets for immediate delivery. No increase in prices.

No. 103-3-bar, 1000 ohm $12.60
No. 104-4-bar, 1600 ohm 14.35
No. 105-5-bar. 1600 ohm 14.85

Western Electric and Stromberg-Carlson sets also in limited quantities.

DEPEND ON SUTTLE



USE ELECTROX RECTIFIERS to Replace Your Batteries

- **Supplies DC power for all types of telephone equipment.**

BATTERY ELIMINATORS — with or without power-off relays for magneto operators' sets.

BATTERY ELIMINATORS—with constant voltage output for PAX and PBX, with or without sub-cycle ringer.

BATTERY CHARGERS — for trickle charging telephone batteries.

AUTOMATIC BATTERY CHARGERS — for exchange batteries.

Write for Additional Information

ARMY E NAVY

Army-Navy "E" Flag Awarded Oct. 24, '42

SCHAUER MACHINE CO.
2864 Reading Rd. Cincinnati, Ohio

of the Farmers & Merchants Telephone Co., Linn Grove, Ia. He succeeds **R. E. Sitz,** who filled in until **Mr. Proctor** arrived after 13 months service in the army.

●

R. W. Trowbridge, of Fulton, Mo., has bought the Ava, Mo., exchange of the Missouri Standard Telephone Co. The name of the exchange has been changed to the Ava Telephone Company. **Mr. Trowbridge** has been employed by the Southwestern Bell for the past nine years. The personnel will remain the same except the new owner will take over the work formerly handled by **W. D. Stephens.**

●

Harry V. Weed, 59, engineer of the Michigan Bell Telephone Co. for the past 34 years, died at his home in Grand Rapids from a heart attack on July 22.

●

Leslie Pate, line chief for the Southeast Missouri Telephone Company is still confined to the Veterans Hospital at Marion, Ill., where he is under treatment and supervision.

●

Fred J. Turner, of Atlanta, Ga., has been elected vice president in charge of public relations of the Southern Bell. **C. L. Kirven,** Kentucky manager of the company, succeeds **Mr. Turner** as general commercial manager. **J. M. McAlister,** of Miami, Fla., succeeds **Mr. Kirven** as Kentucky manager.

●

Glen I. Carson, manager of the Eldora, Ia., exchange of the Central States Telephone Company sustained serious injuries July 19 when a ladder fell throwing him against a brick wall. He was tree trimming.

●

J. R. Porter, president of the USITA, has announced that he intends to call a meeting in September of the Post War Planning Committee of that association, of which he is chairman, to devise a general plan of study of post war problems that will confront the telephone industry.

●

E. T. Johns, manager of the Mutual Telephone Co., Sherwood, O., was seriously injured July 21 when he was knocked headlong 15 feet to the ground after coming into contact with a 6900-volt power line.

●

H. A. Joslyn, president of the Illinois Telephone Association, has appointed an Accounting Committee to devise a set of accounting instructions for small telephone companies. The members are: **O. M. Westrup,** Mattoon, chairman; **Russell Anderson,** Freeport, and **Homer Swartz,** Bloomington.

●

George E. Corke, 59, manager of the Morris exchange of the Illinois Bell and an employee of the company for 40 years, died recently from a lingering illness. He has been succeeded by **Albert J. Swansboro,** former service engineer at Joliet.

●

Arch R. MacKinnon, executive secretary of the New York association, has announced 9 district meetings for that association from August 23 to Sept. 3. The schedule lists meetings at Rhinebeck, Aug. 23; Middleton, Aug. 24; Walton, Aug. 25; Owego, Aug. 26; Jamestown, Aug. 27; Penn Yan, Aug. 30; Fulton, Aug. 31; Cazenovia, Sept. 1; and Plattsburg on Sept. 3.

●

W. E. Nunnely, manager and owner of the St. Jo (Tex.) Telephone Company has announced completion of several metallizing projects. Your Editor has been bird shooting in this vicinity many times and one time found an oil field discovered on our favorite shooting pasture.

●

Walter Scott Bates, 46, general commercial manager for the Long Island area of the New York Telephone Co. died recently at his home. He served an assignment with the WPB on March 15, 1942, and returned to the New York company on August 31, 1942. He served the International Tel. & Tel. Co. and the American Tel. & Tel. Co. during his career.

●

Lt. David McNish, former Ashland (Ky.) Home Telephone Co. plant employee and now stationed with the armed forces in Australia, has succumbed to the charms of an Australian lassie and marriage is already a fact, records the **"Kentucky" Circuit Rider.**

●

Toll Records Broken

Long Lines telephone calls have increased more in the past 36 months ending last April than they did in the preceding 36 years, A. T. & T. statisticians revealed in a statement published in the current Long Lines magazine. For the year ending last April 30 long distance calls reached the all-time figure of 126,676,000 as compared with 61,848,000 for the year ending April 30, 1940. This represents an increase of 64,828,000 messages, a figure which exceeds the growth in Long Lines business during the 36 years prior to 1940.

Kentucky Association Holds District War Conference

By E. L. MALONE

THE District War Conference of the Kentucky Independent Telephone Association held on July 14, 1943, at Ashland, Kentucky, proved to be one of the best district meetings ever held by the Association. Considering the transportation restrictions and wartime conditions, the attendance was fine, there being over seventy telephone men and women present. The registrations disclose that at this meeting a total of twenty companies were represented from twenty-three locations in six states. Throughout the day, enthusiasm and interest was evident and we are confident everyone present felt the time they devoted to this meeting well worth-while.

The meeting was opened at 10:00 A.M. by J. N. Johnson, president of the Association. The invocation was given by Rev. J. S. Faulconer, Pastor of the First Christian Church, Ashland. Mr. G. S. Dunn, chairman of the board, Ashland Board of Trade, extended a most sincere welcome to all the telephone people to the city, and congratulated members of the industry for their contribution to the American way of life. He also complimented them on overcoming many discouraging handicaps that have made the telephone industry today such an important part of all modern business in the Nation.

Mr. Burton W. Saunders, vice-president of the Association, in response to Mr. Dunn's address of welcome, thanked him for the sincere welcome extended to all attending the meeting. Mr. Saunders also thanked him for his remarks concerning the help the telephone industry has given to other industries of the Nation and to the country at large.

The report of E. L. Malone, secretary-treasurer, showed the Association to be in good financial condition, and included a brief resume of the Association's activities since the first of the year. He also expressed his appreciation to the National Association for the important W. P. B. Orders and other information received from them, which in turn, was passed on to all Independent companies in the state.

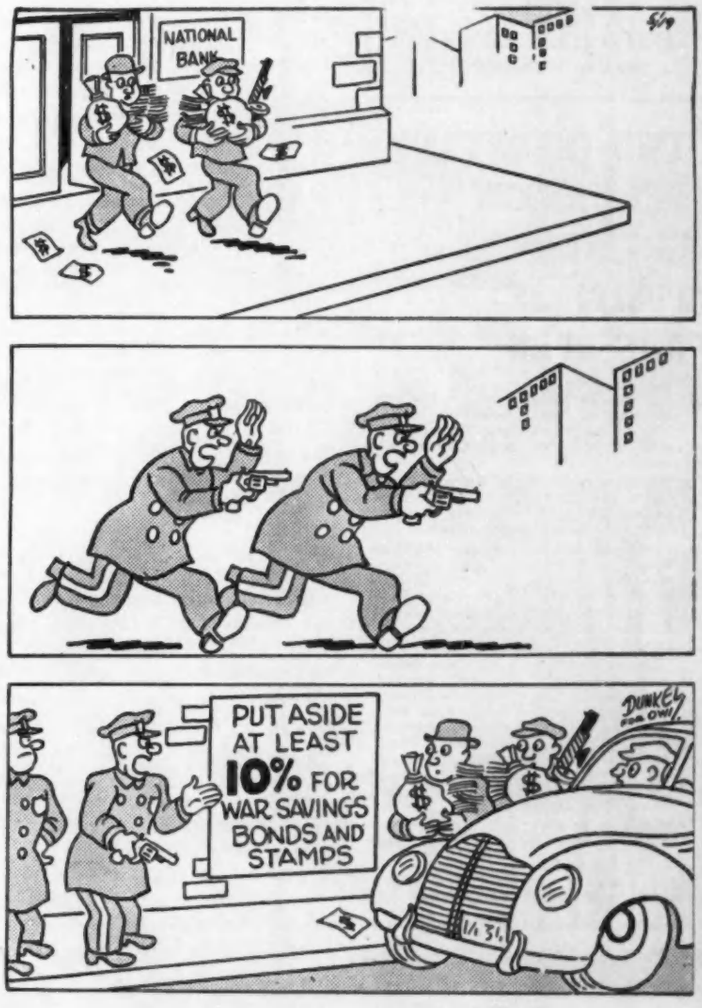
The open forum, "Information Please," conducted by R. A. Maybury, vice-president of the Association, chairman, and H. S. Poage, president and general manager of the Northeastern Telephone Company, included questions and answers pertaining to Plant, Traffic and Commercial problems. The presentation of this discussion proved to be both instructive and interesting as nearly everyone present took part in it.

"Receiving Service Requests under W. P. B. Order U-2" was the subject discussed by Mr. D. H. Lloyd, local commercial manager of the Lexington Telephone Company, Lexington, Kentucky. Mr. Lloyd outlined the highlights of Order U-2; namely, the conservation of scarce and critical material, the discontinuance of further installation or reconnection of residence extensions, service installed on an interim basis only, and the installation of service for producers of substantial quantities of food. He stated that the application of Order U-2 should be made part of our public relations program by convincing the customer the company is cooperating with the Government in the War effort when complying with the provisions of the Order.

Mr. A. S. Crane, general manager of the Portsmouth Home Telephone Company, Portsmouth, Ohio, spoke about "Government Regulations Affecting the Telephone Industry." Assisting Mr. Crane in the presentation of this subject were Mr. Sidlow and Mr. Alter of the Portsmouth Company. The decisions of the War Labor Board as they affect the industry were discussed by Mr. Crane. Mr. Sidlow spoke about the War Manpower Commission Order and its application. The "Withholding Tax," as it is computed, and the responsibility of the employer in reporting the deductions to the Government were discussed by Mr. Alter.

Mr. Lionel C. Hartford, supervising engineer, Defense Plant Corporation, Maplewood, New Jersey, spoke on the subject. "It Can Happen Here," which pertained to Civilian Defense. He stressed the importance of all cities being "defense minded," and described the organization that has been set up in

(Please turn to page 45)



Sturgis
WOOD OPERATOR CHAIRS

No. 222-FR

1. Form fitting back and deep, saddle seat upholstered in genuine leather over curled hair pads.
2. Easy, "floating" swivel mechanism.
3. Available in 4 seat height ranges: 18 to 22"; 21 to 25"; 24 to 28" and 28 to 32".
4. Solid maple frame with all joints glued and dowelled.
5. Wide choice of leathers and finishes.

Sold by Telephone Supply Houses
Manufactured by
STURGIS
POSTURE CHAIR COMPANY
Sturgis, Michigan

TWO IMPORTANT, PERMANENT ENGINEERING POSITIONS ARE OPEN

Connecticut Telephone & Electric Division of Great American Industries, Inc. needs two experienced men in its Meriden, Connecticut plant.

The first man should have a thorough knowledge of acoustics and experience with magnetic circuits and acoustical measurements.

The other man must be familiar with the application and molding technique of plastics. He should have several years of design experience on small electrical apparatus, and an understanding of magnetic and electrical circuits.

"Connecticut Telephone" is a prime war contractor with an assured peacetime future. The two engineers described above will work on both wartime and postwar projects. Write, phone or wire Mr. William R. Curtiss, Chief Engineer, Connecticut Telephone & Electric Division, Great American Industries, Inc. Meriden, Connecticut.

Men now employed at their highest skill in war industry need not apply.

Great American Industries Inc.
70 Britannia St., Meriden, Conn.

First Aid *Training*

(Continued from page 24)

tors are properly selected, thoroughly trained as instructors, given "refresher" work, and kept currently up-to-date on the latest first aid practices and teaching methods.

The American Red Cross has also developed an instructor's outline, and its use helps to insure uniformity of instruction, and also relieves companies of preparing and maintaining their own outlines.

FIRST aid kits, containing standard materials, are tools which help the telephone first aider to apply his knowledge and skill. Three sizes of kits are provided. The large size is kept at convenient locations in central offices, storerooms, and in a suitable place on large telephone trucks. The medium sized kit is usually carried on smaller trucks and kept at locations where only one or two may need it. The small kit is designed for the pocket or tool bag where the larger kits cannot be conventiently carried. Operator's rest rooms are also provided with medicine cabinets containing a selected list of first aid supplies and necessary instructions.

Telephone first aid classes stress the importance of replacing as soon as possible each item taken from the kit, of keeping the materials sterile, and of avoiding the possibilities of infections in case of wounds.

As a means of helping to make first aid a part of the regular plant job, a considerable portion of the first aid textbook has been condensed for inclusion in the Bell System Practices—which are the instructions for constructing and maintaining the telephone plant.

IN addition to this condensed version of the textbook, other closely related information of special significance to outside plant forces and engineers is provided in several sections of the Bell System Practices handbook. These sections concern, for example, the rescue of employees from manholes, from poles, and from "live" circuits. While occupational accidents occur infrequently in the Bell System, the information has been provided and telephone employees are trained in what to do so that they will know how if they should ever be present during such an emergency.

Many companies have conducted first aid contests as part of their training program. During recent years, such contests have usually been confined to district and division competitions. They are also held in some of the companies as a part of evening programs following safety dinners or at similar gatherings. In some cases, the members of the competing first aid teams are selected immediately before the contest by drawing names from a hat. In this way stimulus is given to having the entire personnel proficient in first aid knowledge and skill.

During the past year, first aid was dramatized in an unusual and effective way in one company. In darkened recreation rooms, employees sat tense and alert as huge black bombers raced across the motion-picture screen and bomb-struck buildings dissolved into rubble before their very eyes. As the thunder of warfare diminished and the pictures faded from the screen, curtains parted to reveal the demolished interior of a home. Prone on the floor with the debris lay two victims of the air raid, their clothing torn and stained by "blood" from the make-up kit. Onto the scene of chaos came three first aiders. Then, to a microphone description, they turned efficiently to the assistance of the shocked and bleeding victims. The importance and impressiveness of the demonstration was indicated by a number of favorable comments in the press.

Posters have been used from time to time to call attention to the importance of first aid training and to announce that classes are to be conducted. Articles accompanied by pictures of first aid classes appearing in company magazines or Safety Bulletins have also increased the interest in first aid in the Companies.

MOST of the companies have furnished their employees with printed first aid sheets listing the usual types of home accidents and the first aid care that should be applied. They can be gummed to the inside of the door of bathroom medicine cabinet or any convenient surface.

Telephone companies are making extensive use of first aid motion pictures in classroom work as well as for showing to employee groups assembled upon different occasions. One that has been used by most of the telephone companies is the sound picture titled "Before the Doctor Comes," prepared by the American Red Cross. First aid

subjects in this picture include control of bleeding, care of shock, artificial respiration, traction splinting, care for burns, and transportation of victims.

For years hundreds of Bell System plant men who have been teaching telephone company classes have also volunteered their time and energy to promote first aid by teaching classes in their local communities. During the past year, Civilian Defense organizations have called for a large number of volunteer workers, especially for those qualified as instructors.

A soldier, in an automobile accident, was thrown against the windshield, and sustained severe cuts on his head and face. A telephone man, obeying the first rule of first aid by giving precedence to the most serious injury as he had been taught in the first aid class three months before, applied pressure to the large artery in the soldier's neck to stop the profuse arterial bleeding. The pressure on the artery was maintained sufficiently to control the bleeding on the ride to the hospital which took about 25 minutes. The surgeon who expertly repaired the injuries said that the soldier could have died from loss of blood in a very short time if the bleeding had not been controlled properly.

The twin sons of a telephone employee were playing on the floor at home when one of the boys accidentally swallowed a metal ball. Strangling, he ran toward his father with outstretched hands, gasping for breath. The father picked the child up by the feet and shook him, but this treatment was unsuccessful. He then pried the child's mouth open and stuck his finger down the throat, found the string attached to the ball, and gently and quickly pulled the ball out. This telephone man had finished his first aid training the night before, and firmly believes the training he received enabled him to keep a cool head and to know what to do to save his child's life.

A telephone woman was involved in an automobile accident and suffered a severed artery in her scalp. While her companion walked four and one-half miles over a little-traveled road at night for assistance and transportation, she exerted pressure to stop the flow of blood. Thanks to her courage and to efficient application of first aid to her own injury, she saved her own life.

A telephone man arriving at a coal mine for maintenance work saw men running toward the mine opening, and sensed that an accident had happened. Taking his first aid kit from the truck, he ran to the head of the mine shaft. Then for three-quarters of an hour he faithfully administered artificial respiration to a miner with no tangible results, and was becoming exhausted, when suddenly the victim moaned. Ten minutes later, when a doctor arrived, the miner was breathing with some degree of regularity. Knowledge of first aid methods acquired as a telephone employee, and prompt and sustained action, had saved a life.

An elderly woman fell off a bicycle and severed the artery above the temple when her head hit the curb. A telephone operator who had taken first aid some three months before and was in a nearby house was told of the accident. Investigating, she saw two men trying to place the woman in a car while another was attempting to give her a drink of water. The operator found that the arterial bleeding was bad and suspected a skull fracture—which later proved correct. She checked the bleeding and then got one of the men to hold the pressure point. She telephoned for an ambulance, secured a bandage, and treated the victim for

AMERICAN CROSS-ARM, INC.

YOU CANNOT BUY BETTER CROSS-ARMS
Than Those Which Bear the
American Cross-Arm, Inc. Trade-Mark

"DEPENDABLE"

- THEY ARE WELL SEASONED
- THEY ARE FROM THE BEST GRADE OF WASHINGTON FIR
- THEY ARE SHIPPED PROMPTLY
- THEY ARE RIGHT IN ALL WAYS

Distributed By:

STROMBERG-CARLSON COMPANY
Factory and General Offices: Rochester 3, New York, U. S. A.
Branch Offices: Chicago, Kansas City, San Francisco, Toronto

HEMINGRAYS *ENDURE*

Put These Money-Savers On All Your Lines

HEMINGRAYS don't tax your operating budget. They actually save money because they outlive poles, hardware and crossarms; "keep up their money-saving efforts for 50 years"—one prominent utility reports.

A SECRET glass "batch-mix"—climax of 87 years of experience—plus Owens-Illinois quality-controlled production, results in Hemingrays free of voids, stresses and strains . . . so homogeneous that sudden changes of temperature leave them unimpaired to work perfectly through sun, rain, hail, snow and sleet.

3 FAVORITES ON RURAL LINES—Sturdy, all-purpose Hemingray Number 16. Hemingray Number 42, with its long leakage path keeping "toll" lines trouble free. Number 9 (illustr.), with its drip point petticoat for fast moisture runoff. Get samples.

LOW IN COST and long in service-life...sold only by principal jobbers

DISTRIBUTED BY:

STROMBERG-CARLSON COMPANY
Factory and General Offices: Rochester 3, N. Y., U. S. A.
Branch Offices: Chicago Kansas City San Francisco Toronto

shock and skull fracture. The physician in charge at the hospital highly commended the first aid work performed, which is generally believed to have saved the woman's life.

THESE cases are but a few of those that have occurred during comparatively recent months when telephone men and women have expertly applied their first aid knowledge and skill and relieved the suffering and saved the lives of members of their families, fellow workers, and others who have been the victims of accidents.

The reason that accidents occur less frequently among persons trained in first aid is that these people have been impressed with the necessity of taking constructive steps to avoid accidents. Those trained in first aid tend to be more alert in observing conditions and circumstances possessing accident possibilities, and thus are more likely to look one step ahead before acting. Through their knowledge and skill they promptly take proper care of all injuries and therefore prevent more serious consequences. Hence a thorough knowledge of first aid has proved to be a benefit to the individual, to his family, to his fellow workers, and to the community at large during times of peace and times of war.

First aid knowledge may be considered a valuable personal tool; for the wish to lessen suffering, when combined with the ability to do so, results in a keen satisfaction which is its own reward. Now, with our nation at war, all first aiders realize that through their training they are able to help conserve manpower and check the interruption in war production caused by accidents while at work and when off the job. This is a definite, personal contribution to defense. First aid training repays each individual many times for the relatively few hours required to obtain the training.

Administrative Changes in Signal Corps For Simplified Grouping of Functions

Changes in the administrative structure of the Signal Corps, Army Service Forces, designed to provide for greater flexibility in the organization's job of developing, procuring, maintaining and distributing Signal equipment for the Army, were announced July 10 by the War Department.

Three new services are created under the new set-up—the Engineering and Technical Service, Procurement and Distribution Service and the Personnel and Training Service. All of these services were created to effect a grouping of like functions under centralized control.

In addition, the Army Pictorial Service, formerly under Headquarters, Army Service Forces, has been returned to the jurisdiction of the Chief Signal Officer. Changes have been effected in the organization of the old Signal Operating Service, and its designation has been changed to Army Communications Service.

Under the new organization, the Signal Corps is composed of five operating services. Formerly there were two —the Signal Supply Service and the Signal Operating Service. The Signal Supply Service's functions have been taken over by the newly-created Engineering and Technical Service and Procurement and Distribution Service.

The Chief Signal Officer is Major General Harry C. Ingles, who recently succeeded Major General Dawson Olmstead. Major General James A. Code, Jr., remains as Assistant Chief Signal Officer.

OWNERS OF TELEPHONE PROPERTY

Attention!

As representative of capital for investment your consideration is invited to join in a partnership arrangement, or to sell your Common (controlling interest) Stock in your company.

Long established and operated properties preferred. Arrangement contemplates retention of management unless desirable that retirement plans be mutually perfected.

Factual and corporate information should be presented.

For your protection and pending finalization of some arrangement it is deemed advisable to keep subject confidential.

Interest represented desires reasonably prompt action and will expedite consideration of replies.

Address: Attention, President, Box. 8296
% Telephone Engineer
7720 Sheridan Road, Chicago, 26, Illinois

KENTUCKY REPORT

(Continued from page 41)

Maplewood, New Jersey. Mr. Hartford stated there is too much complacency among some of our people and that it is the duty of every individual to get interested now before it is too late.

"Wartime Cable Maintenance" was the subject discussed by Mr. John J. Moran, general plant superintendent, Portsmouth Home Telephone Company, Portsmouth, Ohio. He stated that now in view of the situation with respect to the use of critical material, it is of the utmost importance to all companies to institute a strict cable maintenance program. Mr. Moran said that proper cable construction will be of great assistance in cutting down on cable trouble. He also stated that the spinning method of cable construction seems to be more satisfactory than the use of rings. Mr. Moran illustrated part of his talk with a blackboard, showing various ways to construct and maintain cable that will reduce the cost of cable maintenance.

"Wartime Toll Traffic Problems" was the subject discussed by Miss Jane Mallory, toll supervisor of the Lexington Telephone Company, Lexington, Kentucky. Miss Mallory said that all toll traffic had increased considerably during the last year. This, with the curtailment of circuits brought about by wartime restrictions on material and a high turnover in the operating force, slows the speed of handling calls and results in a congestion at times. Miss Mallory stated, however, that in spite of these difficulties, the full cooperation of all concerned will help to render a satisfactory service.

Mr. Edwin M. Blakeslee, chairman of the Toll Compensation Committee of the United States Independent Telephone Association and personal representative of Mr. John R. Porter, president of the United States Independent Association, delivered an interesting address on the subject, "Toll Traffic Agreement Considerations." Mr. Blakeslee presented in detail the National Association's answer and statement as Intervener in the proceedings of the Federal Communications Commission directing the American Telephone and Telegraph Company to show cause why its rates for interstate and foreign toll telephone service should not be further reduced. He also explained to his audience the recommendations made by the Toll Compensation Committee of the United States Independent Association, to representatives of the American Telephone and Telegraph Company. Mr. Blakeslee stated that recommendations made by the Toll Compensation Committee received the fullest consideration from the Bell System representatives and a number of the recommendations were accepted in their entirety. All those who heard Mr. Blakeslee's splendid address have a better understanding of the new toll compensation agreement that will result in substantial increases to the Independent Companies.

Commander George Walker, Commanding Officer of the U. S. Naval Training Station, Morehead State Teacher's College, Morehead, Kentucky, presented an interesting talk on "Communications in the Navy." Commander Walker spoke of the methods of communication in the Navy thirty-five years ago, and described the changes that have taken place since then up to the present time.

Due to our activity in World War II, Commander Walker stated he is not permitted to explain in detail the marked improvements in Communication that are used today by the Navy. He also said that adequate communication facilities are vitally important to the success of Navy operations in the prosecution of the War. Commander Walker, in closing, complimented the telephone industry on the work it is doing during this crisis, and expressed his appreciation for the opportunity to participate in our District War conference.

Why We Recommend CHANCE CABLE RINGS

STROMBERG-CARLSON COMPANY
Factory and General Offices: Rochester 3, N. Y., U. S. A.
Branch Offices: Chicago Kansas City San Francisco Toronto

RAYTHEON RECTICHARGER

RectiChargeR & Batteries = Automatic AC—DC Telephone Power System

RECTICHARGERS PREVENT

- Power Failures
- Voltage Variations
- Overcharge and Undercharge
- Poor Ringing
- Short Lamp Life
- Sticking Relays

NO MOVING PARTS mean NO WEARING PARTS

RectiChargeRs increase battery life up to 40%

Distributed By:
STROMBERG-CARLSON COMPANY
Factory and General Offices: Rochester 3, N. Y., U. S. A.
Branch Offices: Chicago Kansas City San Francisco Toronto

Electrical Fundamentals For the Telephone Man

(Continued from page 27)

the battery current through the voltmeter and through the apparatus under test. The voltmeter deflection is proportional to the voltage of the testing battery less the voltage drop in the resistance under test. Thus, we have a means of determining the value of the resistance connected to the ohmmeter terminals by the voltmeter deflection. The exact value of this resistance can be computed by the simple algebraic equation:

$$X = \frac{E - V}{V} R$$

Where X equals the unknown resistance in ohms; E equals the voltage of the testing battery in volts, and V the deflection of the voltmeter in volts, and R the voltmeter resistance in ohms. Fig. 65 shows the circuit of a direct reading ohmmeter.

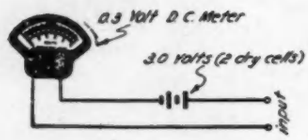


Fig. 65. — Schematic circuit of ohmmeter

Use of Ohmmeter Formula

TO ILLUSTRATE the use of this formula, assume we have a voltmeter having a full scale range of 3 volts and its resistance is 1,000 ohms, Assume we connect an unknown resistance to the voltmeter terminal. If the battery in series with the voltmeter had a voltage of 3 volts and we obtained a deflection of 1½ volts on our meter, then the unknown resistance would be:

$$X = \frac{3 - 1.5}{1.5} 1000 = 1000 \text{ ohms}$$

Ohmmeters purchased from meter companies are, of course, equipped with a scale calibrated directly in ohms. Where it is desired to convert a direct voltmeter for use as an ohmmeter, a conversion table or curve can be easily computed for all of the various voltage readings on the scale using the equation given above. A typical commercial ohmmeter is shown in Fig. 66.

The Wheatstone Bridge

THE Wheatstone Bridge consists essentially of a direct current

Fig. 66. — Popular multi-scale ohmmeter

source which is usually several dry cells, a sensitive D. C. galvanometer, and four resistance arms. In an actual Wheatstone Bridge, three of these arms are variable and the fourth arm consists of the resistance to be measured. Figure 67 illustrates the basic circuit of the Wheatstone Bridge. It will be noted that the galvanometer is bridged between the junctions of the A and X, and B and R arms while the battery is connected at the junction of the A and B, and X and R arms.

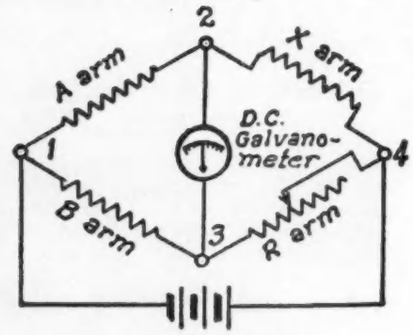


Fig. 67. — Basic Wheatstone Bridge circuit

In an actual bridge, the A and B arms are so arranged that the ratio of their resistances can be varied only over a limited range, while the R arm generally consists of a series of resistances so that any value from 1 ohm to 10,000 ohms in steps of 1 ohm can be obtained.

Operation of Wheatstone Bridge

THE operation of the bridge in making a measurement of an unknown resistance consists in first connecting the unknown resistance to the X arm of the bridge which in an actual instrument consists of two binding posts marked X_1 and X_2. The battery switch is then locked and the R arm adjusted so that the galvanometer gives **zero deflection.** Zero deflection will be obtained whenever **the ratio of arm A is to the ratio of arm B as the ratio of arm X is to the ratio of arm R.** Zero deflection of the galvanometer indicates the bridge is balanced and under this condition the resistance connected in the X arm can be readily computed by the setting of the A, B, and R arms.

Use of the Ratio Arms

WITHOUT going into the mathematics of why this is true, let us consider merely the simplest relationship under which 1,000 ohms would be cut into arm A and 1,000 into arm B. Under this circumstance, the setting of the R arm would have to exactly equal the resistance connected to the X arm in order for the bridge to balance; hence the value of the X arm could be readily determined from the R arm setting. Under this circumstance, the radio of the A to B arm is said to be 1. In actual Wheatstone Bridges, this ratio is adjustable so that it may be made .001, .01, 0.1, 1.0, 10, 100, or 1000. With unequal ratio arms, the setting of the R arm would need to be proportionally higher or lower than the actual resistance cut into the X arm. In other words, a bridge will balance only under the circumstances where the **resistance in the A arm is to the resistance in the B arm as the resistance in the X arm is to the resistance in the R arm.**

Fundamental Bridge Equation

THE fundamental Wheatstone Bridge equation for computing the resistance in the X arm is: A : B = X : R which can be expressed in simplified form as:

$$X = \frac{AR}{B}$$

where X = the unknown resistance connected in the X arm, A = the resistance in the A arm; B = the resistance of the B arm; and R = the resistance in the R arm. Fig. 68 shows how the above equation works out for specific values.

Location of Line Wire Faults

IT WOULD seem that the Wheatstone Bridge is much more complicated than the direct reading ohmmeter and it is true that for ordinary measurements it is an impractical instrument. However, one advantage, aside from its great accuracy, lies in the fact that it can be used to locate faults in telephone or power circuits with real precision.

High accuracy is not possible with the direct reading ohmmeter as the fault may have resistance which would result in an erroneous distance computation. But in the Wheatstone Bridge the fault is **common** to all four arms of the bridge and is used as the point at which current for the galvanometer is introduced thus the fault resistance will not effect the accuracy of the reading obtained. Space does not permit going into this, however, Figure 70 shows how connection is made to a pair of telephone wires on which is a ground fault. In such a case the accuracy of the fault location (based on wire resistance) can be made independent of the resistance of the fault itself, which would not be the case if an ordinary direct reading ohmmeter were used.

NOTE—In the above example the unknown fault was 50 ohms from the strap. The bridge "balanced with R equal to 100 ohms. The formula states that the resistance from strap to fault is equal to one-half of the R arm setting, i. e.

$$X = \frac{R}{2} = \frac{100}{2} = 50 \text{ ohms.}$$

Please note that the X arm carries 150 ohms (100 + 50) and the R arm 150 ohms (100 + 50).

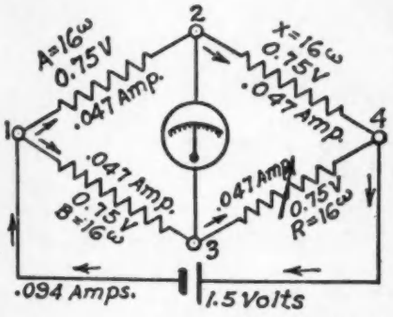


Fig. 68. — Application of basic bridge equation

(To Be Continued)

TURN TO PAGE 56 FOR EXAMINATION NO. 4

Replacing Fire Loss With New Building

The Fayette (Ia.) County Mutual Telephone Company has purchased a lot for a new office building to replace the exchange destroyed by fire in June. The office has temporarily served from a local county building but the new office will house the new exchange in the near future.

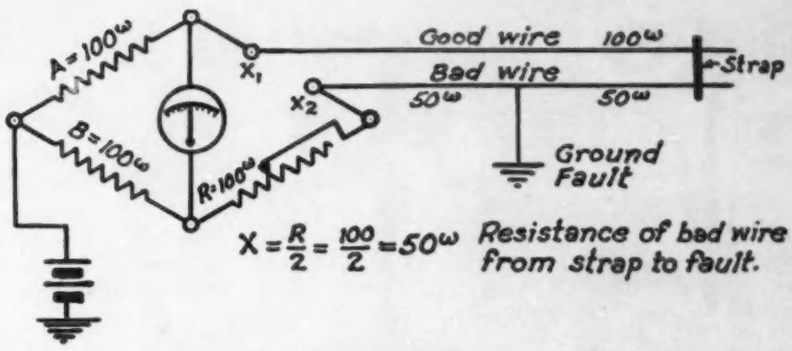


Fig. 70 — Use of bridge for location of faults on open wire lines

AN ATTRACTIVE
CHURCHILL
TELEPHONE BOOTH
Will INCREASE
Your Pay Station Business

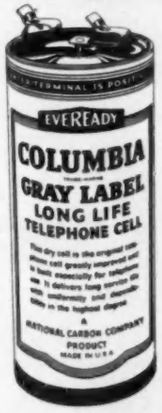
The CHURCHILL No. 100 Folding Door Telephone Booth is built as a single unit and equipped with a reinforced back panel for mounting a wall telephone or coin collector. Made of selected white oak, finished light or medium oak; or of birch, finished light or medium mahogany. Finished inside and out with stain, shellac and lacquer, in a beautiful satin finish. Electric light and electric automatic ventilator are standard equipment. Booth has no floor. Overall height, 84¾"; width, 29"; depth, 30½". Shipped knocked down and crated. Write for literature about this and other CHURCHILL telephone booths.

Distributed By:

STROMBERG-CARLSON COMPANY

Factory and General Offices: Rochester 3, N. Y., U. S. A.
Branch Offices: Chicago Kansas City San Francisco Toronto

Long Life Telephone DRY CELLS



The quality cell preferred by telephone engineers.

"Eveready"
"Columbia"
"Gray Label"

Developed in America's largest dry battery laboratory, this Cell is designed to give both ***longer life*** and ***higher sustained voltage.***

Engineered to one standard of superior quality by specialists in battery manufacture.

Made by the makers of "Eveready" "Air Cell" Operators' Transmitter Batteries.

Distributed By:

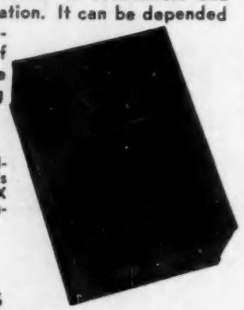
STROMBERG-CARLSON COMPANY

Factory and General Offices: Rochester 3, N. Y., U. S. A.
Branch Offices: Chicago Kansas City San Francisco Toronto

TOPS for RINGING SERVICE

SUB-CYCLE

Sub-Cycle is a powerful ringing converter built for heavy duty. It meets fully every requirement for the ideal ringing machine. There are no moving parts—nothing to adjust—no radio interference—is economical and quiet in operation. It can be depended upon to deliver years of trouble-free signaling service.



Made in 6 Models for loads from Small PBX to Large Central Office.

ALSO PULSATORS

Sold by Leading Distributors

THE LORAIN PRODUCTS CORPORATION
LORAIN, OHIO

Goes Out of Business

Karthaus (Penn.) Rural Telephone Co. of Frenchville in Clearfield County, asked the Public Utility Commission on July 16 to approve abandonment of telephone service in Karthaus Keewaydin, Lecontes Mills and intervening points.

The firm, operated by Mr. and Mrs. Joseph Sayers, said the service is not profitable, and added that the Bell Telephone Co. serves surrounding territory and is equipped to supply service to the communities involved.

"Kellogg Messenger" is Volume 1, Number 1

The Kellogg Switchboard & Supply Company has issued Vol. 1, No. 1 of their new company magazine for employees, the "Kellogg Messenger."

The June issue contains 12 pages of employees and their activities with a frontispiece depicting an armed soldier defending his country. The title of the new magazine was adopted from a suggestion received from J. H. Kellogg, secretary and vice president in charge of manufacturing. Mrs. Tertia Hall of Kellogg's personnel department has been appointed news editor of the magazine. Special credit for the first issue contents go to R. C. Krueger, B. A. Wallace, Walter Fulle and W. P. Lloyd. The publication will be issued monthly.

PROOF!

ACTUAL LABORATORY TESTS SHOW THAT THE "PAPER" METHOD OF OBTAINING METAL TEMPERATURE GIVES HIGHLY VARIABLE RESULTS

LAB-REPORT

"In the test, pieces of paper were inserted in molten solder. Simulating actual field conditions, the thickness and characteristics of the papers varied. Some were newspaper, some wrapping paper, still others light cardboard. These all turned brown at different temperatures. Error was further increased by unbiased observers who disagreed on exact shade of brown in test papers.

EXACT TEMPERATURE

Dillon Temperometer *always* reads the same. No chance for error. Instantaneous. Handy. Priced low to make the job right!

W. C. DILLON & CO. INC. 5410 W. HARRISON STREET CHICAGO, ILLINOIS

Telephone Engineer HANDBOOK TABLES

File—General Data
Date—August 15, 1943.

Subject: Resistance Properties of Conductor Materials

Considerable use is made of resistance wire for resistors in telephone equipment, various alloys of metals with different resistance and temperature characteristics being utilized. Certain alloys also have more or less appreciable thermo-electrical characteristics. Resistance wire with constant temperature coefficient is employed in making resistors for precision instruments such as the wheatstone bridge and voltmeters and ammeters of high accuracy, as temperature changes do not affect the resistance values of the resistors.

Resistance Material	Specific Resistance at 20° C. in Ohms per C'r-cular mil-foot	Temperature Coefficient per Degree C. between 20° to 100° C.	Thermo-Electrical Characteristic-Microvolts per deg. C. against Copper
Silver	9.75	0.0040	
Copper	10.55	0.0040	
Aluminum	17.3	0.0039	
Zinc	38.0	0.0040	
Gold	14.7	0.0038	
Iron (pure)	61.1	0.0062	
Nickel (pure)	58.0	0.0041	25.0
Galvanized Steel	66.7		
18% Nickel Silver	180.0	0.00027	25.0
30% Nickel Silver	241.0	0.000199	
Manganin	290.0	±0.00002	1.4
Lucero	256	0.0019	30.0
Advance (Ideal)	294.0	±0.00002	43.2
Climax (Phoenix)	500.0	0.000978	
Constantan	300.0	0.000000	40.0
Nichrome III	540.0	0.00015	14.0
Comet	550.0	0.00107	5.0
Nichrome IV	650.0	0.00010	
Nichrome	675.0	0.00017	12.0

LENZ HAND SET CORDS

LOOK FOR LENZ THIS MARK OF QUALITY

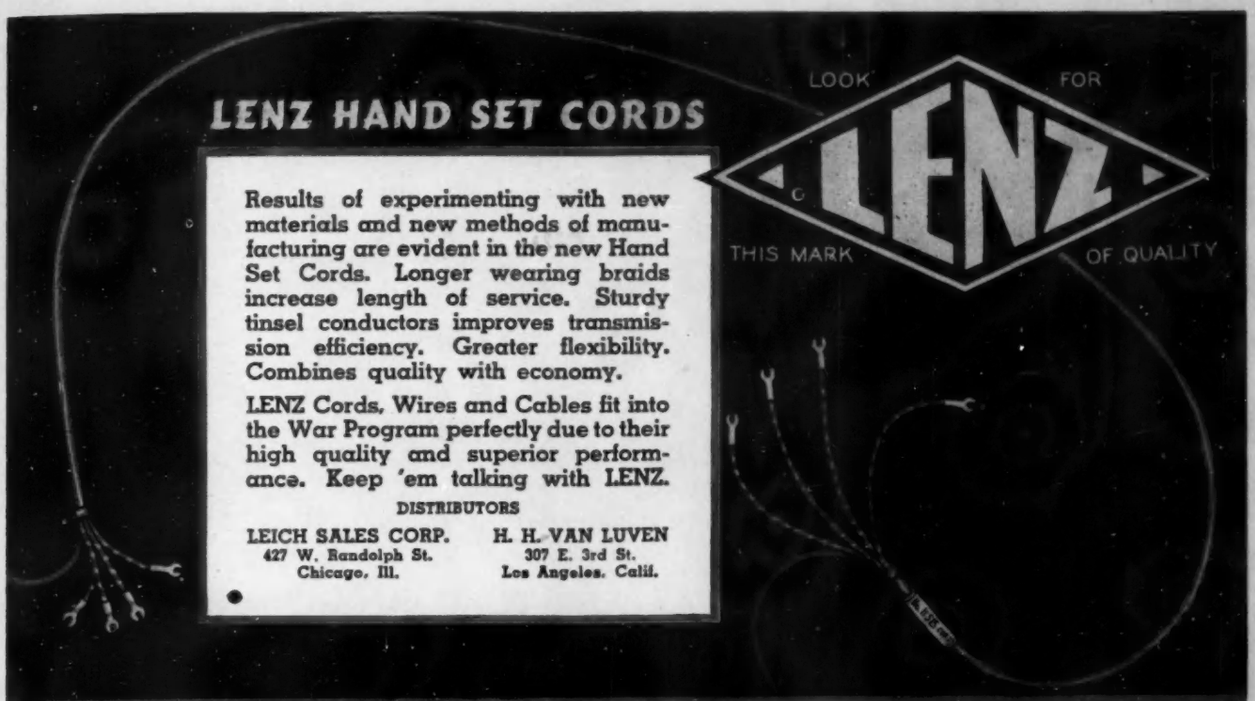
Results of experimenting with new materials and new methods of manufacturing are evident in the new Hand Set Cords. Longer wearing braids increase length of service. Sturdy tinsel conductors improves transmission efficiency. Greater flexibility. Combines quality with economy.

LENZ Cords, Wires and Cables fit into the War Program perfectly due to their high quality and superior performance. Keep 'em talking with LENZ.

DISTRIBUTORS

LEICH SALES CORP.
427 W. Randolph St.
Chicago, Ill.

H. H. VAN LUVEN
307 E. 3rd St.
Los Angeles, Calif.



LENZ ELECTRIC MANUFACTURING COMPANY
1751 N. WESTERN AVE., CHICAGO, ILLINOIS, U. S. A.
"IN BUSINESS SINCE 1904"

Make Your Calculagraphs Last Longer

The increased demand for critical materials and the fact that our plant is taxed to the utmost by war requirements has made deliveries of Calculagraphs slower. Hence, it is important that you get the most out of the Calculagraphs you have.

Calculagraphs require but little attention. But they often do not get the little care they need. Your Calculagraph will do better work and last longer if the type and ribbon platen are cleaned frequently . . . if the lever mechanism and movement are kept free from dirt . . . if ink is not put onto the ribbon and ribbon is replaced before the imprint becomes so faint that handles and mechanism are strained . . . and if oiled lightly and not too often.

Before ordering new Calculagraphs, why not send us your old ones for inspection to see if they can be repaired. Our factory repair department will gladly advise and serve you.

Model 33

CALCULAGRAPH COMPANY
308 SUSSEX STREET HARRISON, N. J.

CALCULAGRAPH
Accurate Toll Timing to the Second!

Calculation of Resistance Networks

(Continued from page 29)

matching. By its use, also, equipment designed to work into one value of impedance may be matched to a circuit of a different impedance with a known loss in the matching network.

From a calculation standpoint, the "T" type network shown in Fig. I is the fundamental type. It is not balanced because the series resistance is all in one side of the line. To make an "H" or balanced type network as shown in Fig. 2, it is merely necessary to cut the values of the series resistances of the "T" type in half and to connect the two halves in the opposite side of the line as shown. The shunt resistance is the same for either type.

T Pad Design

SUPPOSE we require a "T" type network (or "pad" as it is commonly called) with 600 ohms impedance for both input and output which will give a loss of 20 decibels. We refer to Table I, the left-hand column, headed db. Running down the column to 20 db we find, in the two adjacent columns, two factors—the **series arm factor,** .8182 and the **shunt arm factor,** .2020. The next step is to multiply each of these factors by 600 ohms, the desired impedance, to give us the value of the series and shunt resistances as follows:

600x .8182=490.92 ohms series resistance
600x .2020=121.20 ohms shunt resistance

Assuming that Fig I represents the network, the resistances A and B should **each** have a value of 490.92 ohms and the resistance C should have a value of 121.2 ohms. If (instead of a "T" type network) we require an "H" or balanced type, as shown in Fig. 2, we may simply divide the value of the series resistance (490.92 ohms) by 2 giving 245.46 ohms for **each** of the four "arms" of the "H" type network. For ordinary work the decimal fractions may be changed to the nearest whole numbers.

The foregoing description of the method of using Table I is more complicated than the actual use of the table. The "bogey" time for calculating any network is less than a minute.

TABLE II

db	"R" Current or Voltage Ratios	db	"R" Current or Voltage Ratios
.5	.9441	10.5	.2985
1.0	.8913	11.0	.2818
1.5	.8414	11.5	.2661
2.0	.7943	12.0	.2512
2.5	.7499	12.5	.2371
3.0	.7080	13.0	.2239
3.5	.6683	13.5	.2114
4.0	.6310	14.0	.1995
4.5	.5957	14.5	.1884
5.0	.5623	15.0	.1778
5.5	.5309	15.5	.1679
6.0	.5012	16.0	.1585
6.5	.4732	16.5	.1496
7.0	.4467	17.0	.1412
7.5	.4217	17.5	.1334
8.0	.3981	18.0	.1259
8.5	.3759	18.5	.1189
9.0	3548	19.0	.1122
9.5	.3350	19.5	.1059
10.0	.3162	20.0	.1000

Note: To find the ratio corresponding to a number of decibels larger than 20, proceed as follows: Each time the number of decibels is increased by 20, the corresponding current (or voltage) ratio is divided by 10. Example: Suppose we desire to find the ratio corresponding to 25db: Subtracting 20 from 25 leaves 5 db, which is within the range of the table, and the corresponding ratio is .5623. Dividing this by 10, gives .05623 as the ratio for 25db. For 45db the ratio would be .005623 or simply .0056.

If it is desired to use db steps closer than .5db, this may be done by interpolation as in the case of tables of logarithms.

Note that there is a regular geometrical progression in the value of the ratios in steps of 6 db. The ratio for 6db is (approximately) ½; for 12db it is ¼; for 18db it is ⅛; etc. Similarly, starting with the ratio for any number of db's, the successive ratios are ½ of the preceding ratio as the number of db's increases in 6 db steps.

Networks for Unequal Terminal Impedances

TO design a network or pad to work between unequal impedences requires a table giving current (or voltage) ratios corresponding to any desired value of decibels (db). Table II gives such ratios for db values from .5db to 20 db in .5db steps and the note below the table explains how to use it for db values above 20. The values of resistances A, B and C (Fig. I), when the network is designed to match unequal impedances, may be calculated by means of the following formulae:

$$A = \frac{2Z_1 - 2R\sqrt{Z_1 Z_2}}{1 - R^2} - Z_1$$

$$B = \frac{2Z_2 - 2R\sqrt{Z_1 Z_2}}{1 - R^2} - Z_2$$

$$C = \frac{2R\sqrt{Z_1 Z_2}}{1 - R^2}$$

Where, R=Current ratio, as shown in Table II, corresponding to the number of db loss desired.
Z_1=Impedance of the circuit toward resistance arm A.
Z_2=Impedance of the circuit toward resistance arm B.

Suppose we require a "T" type network to give a loss of 20db (as before) but it is required to work between impedances of 150 ohms and 600 ohms. We now have the following values:

R = .1 for 20 db (from Table II)
Z_1= 150 ohms
Z_2= 600 ohms

If we look at the formulae for finding the values of resistances A, B, and C we note that certain mathematical expressions such as $2R\sqrt{Z_1 Z_2}$ and also $1 - R^2$ occur in all three formulae. So it will simplify matters a little if we calculate these separately and then substitute the results in the formulae. It should be understood that where two letters are written together such as $Z_1 Z_2$ under the square root sign, they should be multiplied. Accordingly:

$$2R\sqrt{Z_1 Z_2} = 2x.1\sqrt{150 \times 600}$$
$$= .2\sqrt{90{,}000}$$
$$= .2 \times 300$$
$$= 60$$

Now we may substitute the simple value 60 whenever the more complicated expression $2R\sqrt{Z_1 Z_2}$ occurs. Similarly:

$$1 - R^2 = 1 - (.1)^2$$
$$= 1 - .01$$
$$= .99$$

Now we are ready to find the values of resistances A, B, and C by working out the formulae:

W. C. MEREDITH COMPANY

Inc.

WOOD PRESERVERS'

P. O. STATION "A"
ATLANTA, GEORGIA

•

Pressure Treatments with Creosote

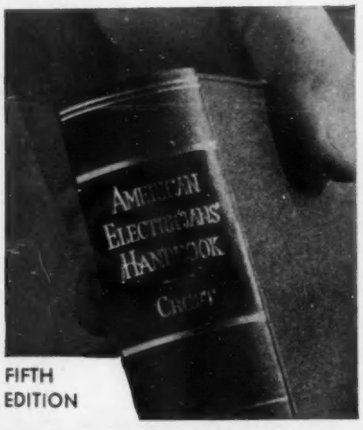
—or—

Chromated Zinc Chloride

•

Stocks of Crossarms, 2" to 4½" Single and 2" to 4" Multiple duct Split Conduit, Cover Plank and Anchor Plank conforming to A. T. & T. Specifications carried at all times.

Get the right answer FAST



FIFTH EDITION

for more efficient, profitable handling of

EVERY TYPE OF PRACTICAL ELECTRICAL JOB

COVERS:

- conductors
- circuits and circuit calculations
- general electrical equipment and batteries
- generators and motors
- transformers
- outside distribution
- interior wiring
- electric lighting
- etc.

Croft's AMERICAN ELECTRICIANS' HANDBOOK

Revised by CLIFFORD C. CARR, Head, Electrical Engineering Dept., Pratt Institute. 1600 pages, 5x7½, 1177 illustrations, $5.00.

OTHER BOOKS FOR THE TELEPHONE MAN

American Standard Definitions of Electrical Terms, by The American Institute of Electrical Engineers	$1.00
Drake's Telephone Handbook, by D. P. Moreton	1.50
Electrical Communication, by Arthur L. Albert	5.00
Electrical Fundamentals of Communication, by Albert	3.50
Standard Handbook for Electrical Engineers, by Knowlton	8.00
Telephone Theory and Practice, by Miller, 3 volumes each	5.00

Order direct from

TELEPHONE ENGINEER PUBLISHING CORPORATION

7720 Sheridan Road — *Chicago 26, Illinois*

To avoid delay please send remittance with order.

HOW Amertel SAVES MAN-HOURS

IN NEW CONSTRUCTION. AMERTEL-85 and AMERTEL-135 wires have extra tensile strength which permits spans of much greater lengths than ordinary wire. As a result, they enable you to save many precious man-hours. Less poles need be installed—less connections need be made. There is also a saving in other materials.

IN MAINTENANCE. The extra strength of AMERTEL Wires provides greater safety—less trouble from heavy ice and wind loads. This is highly important in these times when service must be maintained with a minimum staff of maintenance men.

ALL AMERTEL WIRES — including "EBB," "BB" and "Steel" grades—as well as AMERSTRAND Steel Strand are produced to a high standard of "Controlled Quality." Every production step—from ore to finished product—is under strict control and experienced supervision. The zinc coating is applied by a special process which forms a tight bond with the steel.

These tags are placed for your protection on every coil of AMERTEL Telephone and Telegraph Wire and AMERSTRAND Steel Strand. They are your assurance of highest quality.

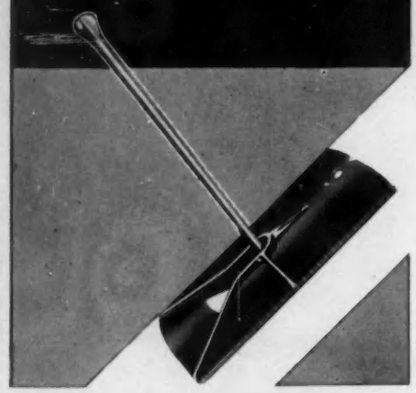
AMERICAN STEEL & WIRE COMPANY

Cleveland, Chicago and New York

USS Columbia Steel Company, San Francisco, *Pacific Coast Distributors*
United States Steel Export Company, New York

UNITED STATES STEEL

Bolt through solid earth for line security



Never-Creep Anchors
waste no holding area

With anchoring, it's the pull against solid earth that counts the most. That's why you get as near 100 per cent efficiency with the Never-Creep Anchor as it is possible to get. None of its area is wasted, because its entire surface pulls directly against solid undisturbed earth. The Never-Creep has only two pieces—rod and plate. It is easy to install and does a real holding job.

A·B·CHANCE CO. CENTRALIA MISSOURI

$$A = \frac{(2 \times 150) - 60}{.99} - 150$$

$$= 242.4 - 150$$

$$= 92.4 \text{ ohms (For one series arm)}$$

$$B = \frac{(2 \times 600) - 60}{.99} - 600$$

$$= 1151.5 - 600$$

$$= 551.5 \text{ ohms (For the other series arm)}$$

$$C = \frac{60}{.99} = 60.6 \text{ ohms (For the shunt arm)}$$

Note: In solving for A and B, the multiplication in the parenthesis should be performed first, then the value 60 subtracted from the product and the difference divided by .99.

This completes the calculation for a "T" type network. If we require a balanced or "H" type network, we simply divide the 92.4 ohms in half and place 46.2 ohms in each side of the line. Similarly, we also divide the 551.5 ohms in half and place 275.75 ohms in each side of the line. Note that the smaller resistance is toward the smaller impedance.

Now we are in a position to calculate the values for networks to introduce any desired loss into a circuit without mis-matching, or to match circuits of unequal impedances with a known loss. It should be realized that a resistance network attenuates all frequencies equally so that no distortion is introduced into the circuit when the network is inserted.

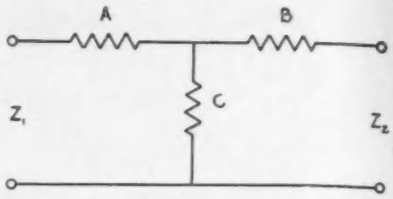


Fig. 1. — T Type Resistance Network.

Typical Problem

WE MAY also have a slight variation of the previous problem. Suppose we want to connect a 150 ohm circuit (or an instrument) to a 600 ohm circuit and our purpose is simply to match impedances with the smallest possible loss. We then make the series arm toward the lower impedance equal to zero. That is, resistance A (Fig. 2) will be eliminated and we need to calculate only the values of B and C. To do this we need to know R, and we cannot look this up in Table II as in the previous case. We must calculate R and the formula is:

$$R \text{ (for minimum loss)} = \frac{\sqrt{Z_2}}{Z_1} - \frac{\sqrt{Z_2 - Z_1}}{Z_1}$$

In this case, as in the previous case, Z_1=150 ohms and Z_2=600 ohms. Then:

$$R = \frac{\sqrt{600}}{150} - \frac{\sqrt{600 - 150}}{150}$$

$$= \sqrt{4} - \sqrt{3}$$

$$= 2 - 1.732$$

$$= .268$$

Referring to Table II, this ratio corresponds closely to 11.5db. The exact value is 11.437db but this is an unnecessary refinement.

Using the value of .268 for R, we proceed as in the previous case and,

$$2R\sqrt{Z_1 Z_2} = 2 \times .268\sqrt{150 \times 600}$$

$$= .536 \times 300$$

$$= 160.8$$

Also:

$$1 - R^2 = 1 - (.268)^2$$

$$= 1 - .072$$

$$= .928$$

Let HOLTZER-CABOT Engineers help solve your ringing problems

4 FREQUENCY MOTOR GENERATOR

This Machine

has no moving conductors. Requires neither brushes or collector rings. Low cost maintenance. Low current consumption. Output 25 watts. Can be furnished with A.C. or D.C. motor drive. Can be equipped with tone and machine ringing interrupters.

For complete information, Write

THE HOLTZER-CABOT ELECTRIC CO.

125 Amory St., Boston, Massachusetts 6161 So. State St., Chicago, Ill.

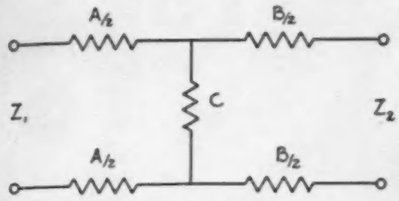


Fig. 2. — H Type Resistance Network.

We are ready now to calculate the value of B and C.

$$B = \frac{(2 \times 600) - 160.8}{.928} - 600$$

$$= \frac{1039.2}{.928} - 600$$

$$= 1120 - 600$$

= 520 ohms (Series arm toward 600 ohm circuit)

$$C = \frac{160.8}{.928}$$

= 173 ohms (Shunt arm)

In this case also the value of resistance B (520 ohms) may be divided in half and 260 ohms may be connected in each side of the line to make a balanced network.

There are other types of resistance networks besides the "T" and "H" (such as "Pi," ladder, etc.), but these are seldom used in ordinary work. The writer trusts that many practical telephone men will experience the fascination of working with a useful device of their own design and construction.

Commission Would End Rate Probes in War-Time

The Pennsylvania Public Service Commission has recently issued a highly interesting declaration of policy which should form a pattern for the ever-agitating Federal agencies with its decision about the inadvisability of regulatory bodies instituting rate investigations of the utilities during the war because of the artificial economic situation now prevailing. The Pennsylvania commission declared it was imperative for utilities to maintain a strong financial position during the war so they can enter the postwar period ready to take up deferred maintenance and rehabilitation of their properties. The commission asked the cooperation of public utilities in refraining from paying dividends or salaries higher than peacetime payments.

Operation of the 45,000-ton United States battleship "Iowa," called the world's greatest fighting craft, is aided by nearly 1,100 telephones.

Gray Paystations—

1. Serve More People
2. Eliminate "Free" Calls
3. Provide Convenience
4. Increase Revenue

Introducing the
New 60 Series

The new Type 60 Series of Gray Paystations are equipped with the exclusive and unique balanced anti-sidetone circuit used in the very newest types of Automatic Electric telephones, assuring exceptional transmission quality. Available in handset or conventional style for automatic or manual exchanges and for postpay or prepay operation.

Right now there's added incentive in increasing your paystation lines. Aside from the added revenue, paystations fill a definite place in the needs of a nation at war.

They provide service for many people who, under present regulations, are unable to obtain private telephones. They furnish the ideal answer for telephone convenience in army camps, in war plant areas and in new housing developments. Installed in plants and offices, they give employees a handy means of making personal calls and at the same time keep the regular switchboard lines free for vital business traffic.

Why not check your paystation lines now, and look for the added possibilities in your locality?

WRITE FOR CATALOG 4078

A complete reference to all types of Gray Paystations as well as a guide book to the best kind of paystation to suit your particular needs. Write for it today—it's yours for the asking.

GRAY PAY STATIONS

DISTRIBUTED BY

AUTOMATIC ELECTRIC SALES CORPORATION

1033 WEST VAN BUREN STREET • CHICAGO, ILLINOIS

PLAN now for that day when essential materials for rebuilding and rehabilitating your lines again are available! It may come sooner than you think.

All post-war planning should include, of course, *Crapo* High-Tensile Line Wire—*Crapo* HTL-85 and *Crapo* HTL-135. These high-strength wires make possible long spans with substantial savings in construction costs, minimize service interruptions, reduce maintenance expense.

Crapo HTL-85 permits spans of from 225 feet in heavy loading to 375 feet in light loading districts; provides increased strength and endurance when used on existing pole structures. *Crapo* HTL-135, with two and one-half times the strength of standard B.B. wire, makes practicable spans up to 350 feet in heavy loading, 500 feet in light loading areas. Both have superior telephonic transmission qualities.

Ask the distributor of *Crapo* Galvanized Products for information about these high-strength wires. Or, write for Bulletins 201 and 202!

INDIANA
STEEL & WIRE CO.
MUNCIE, INDIANA

Station Gains

For the first time the number of telephones served by the New York Telephone Company in its territory in New York State and Greenwich, Conn., has reached and passed the 3 million mark. Figures available up to July 21 show that this total was attained during the week ending on that date.

The gain from January 1 to July 21 was about 107,000, producing a total of approximately 3,004,000 telephones in service. The gain during that period was greater than for any entire year since 1929, when the net addition was around 166,000.

In November, 1940, the number of telephones served by the company had regained and passed, after nearly eleven years, the previous peak of 2,696,600 attained in 1929. With the rapidly mounting telephone requirements resulting from the war, each year of the conflict has shown large gains—92,200, in 1940, 104,600 in 1941, and 82,000 in 1942.

Of the present total, about 1,848,700 are in New York City. This is an increase of about 36,000 since it regained on February 21 last its previous peak, of 1,812,600 reached in 1930.

Nebraska Company is Granted Rate Increase

The Cambridge (Nebr.) Telephone Company was authorized by the railway commission July 8 to increase individual business rates from $2.50 to $3.00, party business, from $2.35 to $2.85; individual residence from $1.50 to $1.80, and party residence from $1.35 to $1.65. The commission found that because of bad economic conditions which forced a reduction in population of the town and abandonment of a number of farms, the company had been operating at a loss of $600 a year for the last five years. As there is little hope of getting back lost subscribers because they are no longer there, the commission said that the new rates, which are less than are charged in other communities, are reasonable. They will yield 3.24 percent on a net investment of $15,640.

Incorporate New Company To Serve in Arizona

Incorporation of the Southwestern Telephone and Telegraph company, Inc., was completed last month and plans were being made for a series of toll lines to be built eastward from Blythe, Calif., this fall and winter.

The president of the new public utility company is Collis S. Mayflower mayor of Blythe. The vice-president is W. G. Keiser, Quartzsite businessman, and the secretary-treasurer is S. D. Kamrar, manager of the Colorado River Telephone company of Blythe, Calif.

The new company has a franchise to operate in Yuma and Maricopa counties in Arizona.

The present toll line from Blythe to Quartzsite will be rebuilt and improved and the line will be extended later to Wickenburg, and possibly to Phoenix. Towns enroute will be served.

EXAMINATION NO. 4

Electrical Circuits and D. C. Instruments

1—What is the difference between the parallel and series circuit? Show by a drawing how four lights would be connected in series and how they would be connected in parallel.

2—Compute the total resistance in a series circuit having four devices whose resistance are respectively 22 ohms, 96 ohms, and 12 ohms, and 10 ohms.

3—Compute the total resistance of a parallel circuit having four lamps whose resistances are respectively 5 ohms, 10 ohms, 20 ohms, and 50 ohms.

4—What are the five classes in which A. C. measurements fall?

5—If we connect a 3 volt battery in series with a 3 volt voltmeter and use this combination to measure the resistance of a coil and we get a deflection of 2 volts, what is the resistance of the coil?

6—Explain the principle of the Wheatstone Bridge. Draw a schematic diagram of a basic bridge circuit.

7—Describe the construction of the D'Arsonval type of D. C. instrument.

8—What is the essential difference between ammeters and voltmeters and what special precautions must be taken in working with ammeters?

9—What is the purpose of shunts and how are they used?

10—Describe the principle of the polarized vane type of meter.

J. Harold Bumby

MacGillis & Gibbs Elect New President

MacGillis & Gibbs Company of Milwaukee, known to the telephone industry for the last 45 years as producers of cedar poles, recently elected J. Harold Bumby to head the organization as president. J. E. Gerich, previous president and under whom the company grew to large proportions, becomes chairman of the board.

Mr. Bumby brings to the MacGillis & Gibbs Company a wide and varied business experience and a long and successful record in many enterprises. In addition to his duties with the pole business, he will serve as secretary and treasurer of the Advertisers Manufacturing Company of Ripon, Wisconsin.

O. W. Maraska

Other officers and executives appointed for the company are as follows: Clark M. Robertson, vice president; E. Koester, vice president; Frank D. McIntyre, treasurer; H. Spettel, secretary; and O. W. Maraska, sales manager. The present personnel will be continued at the general offices in Milwaukee and at all plants and sales offices.

The MacGillis & Gibbs Company is known to the telephone field as a producer of Western Red cedar and Northern White cedar poles. It has treating plants and storage yards located at Minnesota Transfer, Minn., and at Gladstone, Mich. The company also has large timber operations in British Columbia.

Companies Not Obligated to Retain Incompetents

The War Manpower Commission has recently announced that:—"In so far as it will not interfere with the effective prosecution of the war, no employer shall be obliged to retain in his employ a worker who is incompetent to perform the work to which he has been assigned or other suitable work offered him by the employer, or who fails to conform to reasonable shop rules or standards of conduct."

For Quicker Longer Service

SYLVANIA TUNGSTEN TELEPHONE SWITCHBOARD LAMPS

ACTUAL SIZE

FASTER—Light up in one-fifth second.

BRIGHTER—Maximum end-on candle power. Sharper daylight signals.

STRONGER—Average life 1,500 hours of high brilliancy. Strong breakage resistant filament. Tight, correctly formed bases.

Available in: CLEAR
NATURAL RUBY*
NATURAL GREEN*

*While present supply lasts

SYLVANIA
ELECTRIC PRODUCTS INC.
SALEM, MASS.
Formerly Hygrade Sylvania Corporation

You can rely on Pole line Hardware that bears the L-M trademark

LM

✓designed the way you want it
✓built to last
✓packed for convenience
✓RIGHT in ALL WAYS

LINE MATERIAL COMPANY

Represented By AUTOMATIC ELECTRIC SALES CORPORATION

★ ★ ★ ★ ★ ★

NATIONAL DEFENSE

★ ★ ★ ★ ★ ★

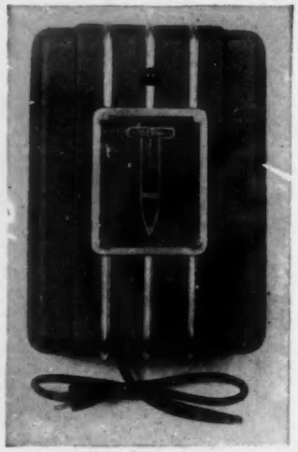
has

PRIORITY

While "all-out" National Defense cooperation is taxing our production facilities — We are proud we have been able to continue to make satisfactory deliveries to our government and to our customers in the telephone field.

TELERING

Reliable ringing service is essential in providing satisfactory telephone service.



Directly converts Commercial Alternating Current to Telephone Ringing Current—Current Consumption Negligible—Positively NO radio interference.

Use TELERING and provide the MOST reliable service at the LEAST cost.

Order through your jobber or direct from

TELKOR, Inc.
ELYRIA, OHIO

Telephone Man Wounded At Guadalcanal

Elmer Egger, former business office employee of the Lincoln (Nebr.) Tel. & Tel. Company, is back home from the Pacific theatre convalescing from wounds received during the early days of fighting in Guadalcanal.

One encounter the Master Sergeant had almost makes your hair stand on end as his Jap opponent came at him with fixed bayonet. Unable to completely dodge the thrust he was able to pull his Commando knife and made one back hand swipe with the satisfying result of eliminating completely one Jap from the island. The bayonet wound was under the chin but has now healed completely. He also was shot in the foot and suffered a nervous condition because of the conditions necessary to live under during the early days of the fight in the Solomans. He is recovering rapidly and anxious to be back in the harness.

Acquire Hooper (Nebr.) Telephone Company

The West Iowa Telephone Company during late July purchased the controlling stock of the Hooper (Nebr.) Telephone Company formerly managed by the late M. E. Shipley. Announcement was made July 29 of the purchase which informed subscribers that the company would retain its name but be managed by the new group. The company was originally incorporated in 1901 by Mr. Shipley.

The new officers elected were: J. H. Windhusen, president; F. W. Daubendiek, treasurer; and W. H. Daubendiek, secretary. The Daubendiek men are from Remsen, Iowa, where they are actively interested in the West Iowa Telephone Company which operates 8 exchanges in Northern Iowa.

The Hooper company has exchanges in Hooper and Uehling, Nebr. Preliminary plans as announced call for placing all heavy lead lines in underground cables and doing away with a multitude of telephone poles now in use. These plans are to be put into operation as fast as the cable and other necessary vital materials can be secured, a process upon which wartime restrictions will have influence and bearing, but which in time will be successfully accomplished.

The former directors of the Hooper company early in June petitioned the railway commission for an increase in rates. We have not been informed of the action of the commission.

Ohio Company Name Changes

Highland County Telephone Co. is now an integral part of the Ohio Bell Telephone Co. and henceforth will operate under the latter name.

Actually no change will be apparent except on the company's stationery and the name on the front of the telephone office. The Ohio Bell has for a long time owned the controlling stock of the Highland County Telephone Co., but the latter had been directed and operated as a separate entity.

WPB Compilation of Surplus Cable Published

A COMPILATION, showing surplus stocks of cable and composite cable offered for sale by telephone operating companies under the voluntary redistribution plan of the telephone industry has just been distributed by WPB Communications Division Director Leighton H. Peebles to equipment manufacturers, the major telephone companies and the Independent telephone associations.

The tabulation which shows the listing of surplus stocks of different types of cable and composite cable has been sent to twenty-eight communication equipment manufacturers; eighty-three telephone operating companies which represent approximately 89% of the industry measured by telephones in service; thirty-four state telephone associations and the United States Independent Telephone Association.

The goal of the tabulation is to make available to those telephone companies requiring cable for essential maintenance and repair or other projects essential to the war effort the fact that cable of the specifications listed exist and can be obtained at the prices offered by the operating companies. The Communications Division is urging the telephone companies to purchase and use this surplus cable before making any inquiries for the purchase of cable from the wire mills. Director Peebles stated that "this practice will prevent drawing upon the nation's stockpile of critical materials as well as the labor supply and facilities."

Both Bell System and Independent companies offered surplus stocks in this tabulation which was completed on the basis of returns submitted to the Division as of last July 15.—R. C. D.

Kellogg Names J. M. Lindsey Division Service Engineer

J. M. Lindsey

The recent appointment of J. M. Lindsey a telephone man with over 29 years experience, to the post of Division Service Engineer is a move certain to receive the acclaim of Western members of the telephone industry. He has been with the Kellogg Company since 1937.

Starting in 1914 as a switchboard repairman, Mr. Lindsey's ability won him consistent recognition. By 1928, he had served as switchman, chief switchboard man, transmission engineer and supervisor of toll maintenance. While in charge of the maintenance of the huge Kellogg switchboard installed in the combined Cedar and Osage exchange at Tulsa, Oklahoma, he became thoroughly familiar with Kellogg equipment and was completely sold on Kellogg quality and efficiency.

In 1928, Jim went to Mexico to organize and instruct personnel for the operation of the first toll network in that country. He remained in Mexico until 1933 as general superintendent of long lines, then returning to the United States to assume duties as transmission engineer with an associated company of the I. T. & T.

Mr. Lindsey became associated with Kellogg in 1937 as service representative in Texas, New Mexico and Louisiana. Here his expert knowledge plus his friendly helpfulness has since won him a host of friends.

As division service engineer, Mr. Lindsey will operate out of Kellogg's Kansas City Office. By establishing his headquarters in this central western city, Kellogg has insured a much greater outlet for the experience and ability for which Jim is noted.

WPB Awards Certificate of Merit to F.E. Pratt

An invention which tests secret communications equipment 32 times faster per unit has brought Francis E. Pratt, Instrument Laboratory Engineer at the Stromberg-Carlson Company, Rochester, N. Y., the War Production Board's certificate of individual merit, the company announced Aug. 2.

Pratt's contribution, which consists of a differential pressure gauge, not only makes a more definite test than has previously been achieved, but also eliminates duplicate handling of the equipment. The U. S. Signal Corps considers Pratt's development a real contribution to aircraft communications equipment especially as it is inexpensive compared to other methods.

A native of Dubuque, Ia., Pratt attended schools in Washington, Iowa, and Illinois. He received degrees from Iowa State University and Northwestern University.

Pratt is the second production solder of the company to be recognized by the WPB within a year. Madison Butler, an assistant inspector at Stromberg-Carlson, invented a simple device for testing communications equipment which has cut the testing time for one instrument from eighty man hours to one man hour.

Test-O-Lite

TESTS ANY VOLTAGE . . .
100 to 550 Volts, A.C. or D.C.
—Safely, Swiftly, Surely

THE NEON GLOW
LOCATES TROUBLE INSTANTLY

In electric circuits, fuses, cutouts, motors, radios, appliances, etc.

FUSES

MOTORS

OUTLETS

PUTS "FINGER" ON THE TROUBLE SPOT

Indicates hot or grounded wires. Tells AC from DC. Far superior to ordinary clumsy test bulb. Indispensable in shop or home. Has PATENTED safety features. Vest pocket size with clip. Life time guarantee. List $1.50 at leading jobbers.

L. S. BRACH Mfg. Corp.
55-63 Dickerson St. Newark, N. J.

DOES THIS APPLY TO YOUR FIELD?

Give the boys a break!

A telephone is a big thing in every fighting man's life! Now that critical materials may be used to build and repair pay stations, install Gray equipment wherever people congregate. This will be a boon to soldiers, a relief to civilians denied new private telephones, and a definite benefit to you. Tell us how many stations you need and what obsolete equipment you have. We will make prompt recommendations.

THE GRAY MANUFACTURING CO.

HARTFORD, CONNECTICUT

AUTHORIZED AGENTS — Automatic Electric Sales Corp. — Graybar Electric Company — Kellogg Switchboard & Supply Company — Leich Sales Corporation — The North Electric Mfg. Co. — Stromberg-Carlson Co. — Canadian Telephone & Supplies, Ltd. — Northern Electric Co., Ltd.

The Clearing House

For the convenience of readers of Telephone Engineer

LOOMIS ADVERTISING CO.

A SALES ORGANIZATION *exclusively..*

That Has Never Failed to Produce More Net Revenue (All Costs Considered) for Telephone Companies Served.

IF INTERESTED in more net telephone directory revenue write or call at our expense.

LOOMIS ADVERTISING CO.

408 Olive St., St. Louis, Mo.

Chisens Trust Bldg., Fort Wayne, Ind. — 135 So. Second St., Philadelphia, Pa.

Reconstructed Equipment

North Line and Cut off relays for all relay boards, per pair @	$ 3.00
Auto Elec. All bakelite Enclosed gong signal sets with straight line ringer and Cond. No Ind. Coil @	3.25
H. C. Motor Gen. Ringing Machine, Motor 220 Volts D. C. Shunt Wound. Type H. D. Gen. Type MSW 80 volts 20 Cycle @	50.00
Switchboard cord weights @	.20
Kellogg or Dean 100 ohm drop coils @	.35
S. C. No. 9 Talk through Repeating coils @	1.25
Auto Elec. or Kellogg 2 M. F. Condensers @	.35
Western Elec. No. 323 Transmitters less back $1.15-with back @	1.25
Kellogg No. 404 Steel bell boxes with Straight line or 16-33-50 or 66 cycle harmonic ringers and Ind. Coil. Wired Booster Ckt. @	4.25
Kellogg or W. E. New Composition Rec. Shells and caps @	.45
Stromberg No. 69A Protector rack with fuses and carbons 20 lines per strip @	3.00
Kellogg No. 115 Grabaphones with 3 Cond. Cord @	5.00
Stromberg No. 55 Slightly Used 3 Cond. Swbd. Plugs @	.65
Monarch L. B. Transmitters complete with M. P. and Back @	.90

REBUILT ELECTRIC EQUIPMENT CO.
1704 West 21st Place
Chicago 8, Illinois

C. S. Powell Named

Chas. S. Powell

Effective August 15th, according to an announcement made recently by A. H. Nicoll, Graybar president, Charles S. Powell is appointed manager of the Communications and Merchandising Department at headquarters offices in New York.

Mr. Powell's place as district manager at Boston will be taken by W. H. MacCrellish, now district manager at Cincinnati. The new Graybar district manager at Cincinnati will be A. D. Hammond, now manager at Birmingham. Douglas Wallace, now sales manager of the Communications and Merchandising Departments at New York headquarters, will become district manager of Pittsburgh on September 1st. A. R. Loughborough, now district manager at Pittsburgh, will retire on December 31st, after 39 years of outstanding service. Until that time, Mr. Loughborough will act in a consulting capacity at Pittsburgh.

AN ANSWER!

Black Sea, Bosporus, Aegean Sea, Mediterranean Sea, Suez Canal, Red Sea, Gulf of Aden, Arafinan Sea, Indian Ocean, Strait of Malacca, South China Sea.

ARE YOU AN INDEPENDENT TELEPHONE PIONEER?

Apply today to J. K. Johnston, secretary, Lemcke Building—Indianapolis, Indiana

Telephone Engineers

JAY G. MITCHELL
Consulting Engineer
Operating and Management Economics
Plant—Equipment—Revenue
EATONTOWN, NEW JERSEY

J. G. WRAY & CO.
Telephone Engineers
Specialists in Appraisals, Rate Surveys, Financial Investigations, Organization and Operation of Telephone Companies
105 West Adams Street
CHICAGO

J. W. WOPAT
CONSULTING ENGINEER
Telephone Engineering — Construction Supervision — Appraisals — Financial — Rate Investigations
1510 Lincoln Bank Tower
Fort Wayne, Indiana

Telephone Repair Co.
Repair service for Transmitters, Receivers, Desk Stands and Wall Phones—Magneto or Common Battery.
Specialists in Repairing and Rebuilding Transmitters
WE TRADE
WE BUY
WE REBUILD
Old telephones or parts into smart modern-looking wall phones or desk sets with new cabinets.
Telephone Repair Co.
Daniel H. McNulty, Manager
Rogers Park Station — Chicago

Finished Cedar Poles
VALENTINE CLARK CORPORATION
St. Paul, Minn.

Classified Ad

PERMANENT POSITION—wanted as Wire Chief or combination plant man, married, 38 years old, 10 years experience in Automatic, common battery, and magneto exchanges. Address BOX 8302, c/o TELEPHONE ENGINEER.

The Clearing House

For the convenience of readers of Telephone Engineer

"The ABC of Electronics at Work"

The fundamental principles of the six basic ways in which electronic tubes function are explained in a new 36 page booklet announced by Westinghouse Electric and Manufacturing Company.

Schematic drawings of the tube construction and diagrams showing the typical circuits for the various functions are used to explain how electronic tubes rectify, amplify, generate, control, transform light into current and current into light. Industrial and military applications for each of the six basic functions are described and illustrated in this booklet, "THE ABC of ELECTRONICS AT WORK." High frequency heating, dynetric balancing, resistance welding control, radio and radio-telephony, television, Precipitron, industrial and medical x-ray are a few of the electronic devices that are included.

A copy of booklet B-3260 may be secured from Department 7 N 20, Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa. by mentioning TELEPHONE ENGINEER.

Cook Electric Nurse Wins Newspaper Award

Mrs. Ruth Stramel, plant nurse and former production line worker at the Cook Electric company, 2700 North Southport Avenue, Chicago, has joinen the ranks of The Chicago Tribune woman worker award winners by capturing the July award—a $25 war bond and an engraved certificate of merit.

Mrs. Stramel, a petite, dynamic little woman with sparkling black eyes, started working at Cook Electric six years ago, when there were only 60 employes (there are now now 700). She worked successively as inspector, assembler, and office assistant and for four years doubled both on the production line and as company nurse.

CLASSIFIED

Use TELEPHONE ENGINEER for all types of classified ads. Cost is 7c per word with a minimum of $1. If you need a job the ad is FREE to subscribers.

WANTED AT ONCE: Woman to operate small magneto exchange in North Carolina on agency basis. Living quarters furnished. Desirable arrangement for middle aged woman and daughter. Write Central Carolina Telephone Company, Southern Pines, North Carolina.

WANTED: Agent for magneto exchange 225 stations. Would consider man and wife—husband to be employed as trouble man or lineman. Write Box No. 8300, c/o TELEPHONE ENGINEER.

TELEPHONE DIRECTORY ADVERTISING

L. M. BERRY & CO.

Write or Telephone for Proposition

TELEPHONE L.D. 16
TELEPHONE BLDG., DAYTON, OHIO

SPLICER'S TOOLS
Of Top Quality by **UNIQUE**

- FURNACES
- SOLDER POTS
- BLOW TORCHES
- WIPING CLOTHS
- BALANCED LADLES
- SOLDER IRON HANDLES
- THAWING TORCHES
- FOLDING SAFETY SHIELDS

Protect Public, Splicer, and Furnace. No. 50 C Shield shown here. Of 22 Ga. galvanized steel. Reinforced edges. 23"x17" x17". No. 50—four-sided with grate. No. 50 A—same without grate.

Your Jobber Has These Tools
UNIQUE MANUFACTURING CO., INC.
221 W. Walton St. — Chicago, Ill.

LOOK! at the two wiped joints below—

DO THEY LOOK FINE
WELL I SHOULD SMILE
WE'VE MADE WIPING CLOTHS
FOR A GOOD LONG WHILE

"Williams" WIPING CLOTHS
GEO. E. WILLIAMS, Mfr.
3035 Aldrich Avenue Minneapolis, Minn.

AVAILABLE SOON
11 SECTIONS
(22 POSITIONS)
WESTERN ELEC. CO. No. 8 SWITCHBOARD
AND ASSOCIATED EQUIPMENT

This Equipment is Now in Service and Can be Inspected by Appointment.

For Additional Information Address
BUCKEYE TELEPHONE & SUPPLY COMPANY
COLUMBUS, OHIO

THIS MAN

wants to help you make your postwar plans. He is a NORTH Engineer with a full knowledge of your Telephone Exchange problems and how NORTH ALL-RELAY Dial Automatic Telephone Equipment can solve them for the new era ahead. Write

THE NORTH ELECTRIC MFG. CO. • Galion, Ohio

Index to Advertisements

Acme Visible Records, Inc. —
Acorn Insulated Wire Co. —
Affiliated National Hotels. —
Allen Co., Inc., B. L. —
American Coach & Body Co. —
American Creosote Works. —
American Crossarm & Conduit Co. —
American Crossarm, Inc. 43
American Elect. Heater Co. —
American Steel & Wire Co. 53
American Photocopy Equip. Co. —
American Tel. & Tel. Co. 14, 15
Anaconda Wire and Cable Co. —
Armstrong Cork Co. 7
Automatic Electric Co. 32, 33, 34
Automatic Elec. Sales Corp. 11, 55

B

Banks Mfg. Co. —
Barnard Co., B. S. —
Bartlett Mfg. Co. —
Bell Lumber & Pole Co. —
Berry & Co., L. M. 61
Brach, Mfg. Co., L. S. 59
Buckeye Telephone & Supply Co. 61

C

Cable Spinning Equipment Co. —
Calculagraph Co. 51
Carney & Co., B. J. —
Carpenter Mfg. Co. —
Chance Co., A. B. 45, 54
Channel Splicing Machine —
Chisholm-Ryder Co., Inc. —
Churchill Cabinet Co. 7, 47
Cinaudagraph Corp. 62
Coffing Hoist Co. —
Communication Equipment & Engineering Co. —
Con P. Curran Printing Co. —
Cook Electric Co. 6, 31
Cope, Inc., T. J. —
Copperweld Steel, Inc. 64
Cramer Co., Inc., R. W. —

D

Davey Tree Expert Co. —
Davison Chemical Corp. —
Dicke Tool Co., Inc. —
Dillon & Co., W. C. 43

E

Electric Storage Battery Co., The. 13
Estwing —
Eveready Dry Cells —
Everstick Anchor Co. —

F

Fansteel Metallurgical Corp. —
Federal Tel. & Radio Corp. —
Forged Steel Products Co. —
Fyr-Fyter Co. —
Four Wheel Drive Auto Co. —

G

Gardiner Metal Co. —
General Cable Corp. 11
General Electric Co. —
Graybar Electric Co. 12
Gray Manufacturing Co. 55, 59
Great American Industries, Inc. 42

H

Hammond Drierite Co., W. A. 7
Herdrick & Boggs —
Highway Trailer Co. —
Holtzer-Cabot Electric Co. 54
Hubbard & Co. —

I

Indiana Steel & Wire Co. 6, 56
International Tel. & Tel. Corp. —

J

Jackson Lumber Co. —

K

Kearney Corp., Jas. R. —
Kellogg Switchboard & Supply Co. 4, 5, 6, 7
Kester Solder Co. —
King, W. T. —

L

Leeds & Northrup Co. —
Leich Sales Corp. 2, 3
Lenz Electric Mfg. Co. 51
Line Material Co. 57
Littelfuse, Inc. —
Loomis Advertising Co. 60
Lorain Products Corp. 48

M

Matthews, Corp., W. N. —
MacGills & Gibbs Co. —
Meredith Co., Inc., Wm. C. 53
Michigan Pole and Tie Co. —
Jay G. Mitchell 60
Moss Tie Co., T. J. —
Murdock Co., Wm. J. —

N

National Carbon Co. 47
National Telephone Supply Co. 63
Naugle Pole & Tie Corp. —
North Electric Mfg. Co. 62

O

Oliver Iron & Steel Corp. —
Oneida Cedar & Lumber Co. —
Owens-Illinois Glass Co. 45

P

Page and Hill Co. —
Paine Co., The —
Pearl, Wm. H. —
Peatrophone Corp. —
Pensacola Creo. Co., Inc. —
Paragon Electric Co. 6
Porter, Inc., H. K. —
Philco Corp. 18
Phillips Electrical Works, Ltd. —
Premax Products —
Putnam & Co. —

R

Raytheon Mfg. Co. 6, 39, 45
Rebuilt Electric Equipment Co. 60
Reliable Electric Co. 35
Roebling's Sons Co. John A. —
Runzel Cord and Wire Co. —

S

Schauer Machine Co., The 40
Selenium Corp. of America —
Seymour Smith & Son, Inc. —
Shallcross Mfg. Co. —
Sherron Metallic Corp. —
Siemens Bros. & Co., Ltd. —
Speedometer Elec. Co. —
Star Expansion Bolt Co. —
Stromberg-Carlson Co. 16, 17, 43, 45, 47
Sturgis Posture Chair Co. 22
Suttle Equipment Co. 40
Sylvania Electric Products Inc. 57

T

Taylor-Colquitt Co. —
Telephone Print Co. —
Telephone Repair Co. 60
Telephone Engineer 49, 50, 53
Telkor, Inc. 58
Texas Creosoting Co. —
Triplett Electrical Instrument Co. —

U

Unique Mfg. Co. 61
Union Carbide & Carbon Co. —
U. S. Rubber Co. —
U. S. Steel Corp. 53
U. S. Independent Tel. Assn. —

V

Valentine Clark Corp. 60

W

Wagner Malleable Products Co. —
Western Electric Co. 37
Whitney Blake Co. —
Williams, Geo. E. 61
Wopat, J. W. 60
Worth Hotel —
Wray & Co., J. G. 60

Y

York-Hoover Body Corp. 8